Prepared for

United States Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202

TECHNICAL MEMORANDUM SUPPLEMENTAL NORTH DIKE AREA SITE INVESTIGATION AND EVALUATION OF ORIGINAL REMEDY

BAILEY SUPERFUND SITE ORANGE COUNTY, TEXAS

Submitted by

Bailey Site Settlors Committee

Prepared by

GEOSYNTEC CONSULTANTS
1100 Lake Hearn Drive, NE, Suite 200
Atlanta, Georgia 30342

Project Number GE3913-04

October 1995

801456

ERRATUM

Technical Memorandum
Supplemental North Dike Area Site Investigation
and Evaluation of Original Remedy
Bailey Superfund Site
Orange County, Texas
October 1995

The following change should be made to the above document:

Page i, Paragraph 3, Line 1 should read, "The field work consisted of excavating thirteen test pits..."

EXECUTIVE SUMMARY

This document has been prepared by GeoSyntec Consultants, Atlanta, Georgia (GeoSyntec), on behalf of the Bailey Site Settlors Committee (BSSC) to present the data obtained from supplemental site investigation activities in the North Dike Area of the Bailey Superfund Site, located in Orange County, Texas. This work product is the result of Task 4 "*Supplemental North Dike Area Site Investigation and Evaluation of Original Remedy*" of the Focused Feasibility Study (FFS) Work Plan, Revision 1, prepared by GeoSyntec for the BSSC and dated 15 August 1995.

The supplemental site investigation was performed to better define the composition and nature of the waste material in the North Dike Area. Previous investigations and studies did not sufficiently characterize these materials for an evaluation of the technical feasibility of solidification/stabilization technologies (i.e., waste component types, particle size, heterogeneity, and presence of solidification inhibitors).

The field work consisted of excavating twelve test pits in the North Dike Area. The excavation of each test pit was carefully logged and documented to provide an estimation of the gross composition of the wastes. Bulk samples were obtained at several depths from each test pit. The bulk samples were hand sorted and sieved to estimate the composition and particle size distribution of the smaller waste fractions.

Laboratory testing consisted of testing of selected waste samples for loss on ignition in order to estimate the percentage of organic material in the waste. Soil samples taken from beneath the waste were also tested to evaluate certain physical properties that will be used in the evaluation of alternative remedies.

Based on the results of the field investigations and laboratory testing, GeoSyntec concludes that a variety of municipal and industrial wastes were co-disposed in the North Dike Area. These wastes include a high proportion of large items of debris and have a high organic content (4% to 51% as determined by loss on ignition). This conclusion is significant since USEPA and industry recognize the infeasibility of stabilizing municipal waste, wastes containing a high proportion of debris, and wastes that have a high organic content.

GeoSyntec also evaluated the solidification component of the original remedy in accordance with the screening process presented in "*Stabilization/Solidification of*

CERCLA and RCRA Wastes" [EPA/625/6-89/022]. Based on this evaluation, solidification of the North Dike Area wastes is not technically feasible because engineering solutions are not viable for the removal of problematic waste components.

GeoSyntec has reviewed several documents that establish USEPA's position with respect to the stabilization of problematic wastes. The presumptive remedy directive "*Presumptive Remedy for CERCLA Municipal Landfill Sites*" [EPA 540-F-93-035] indicates that USEPA recognizes the difficulties associated with the treatment of municipal wastes because of the size and heterogeneity of the waste components. USEPA also recognizes that *"organics typically interfere with the conventional stabilization processes, particularly at concentrations exceeding 1% TOC"* [40 CFR, June 1990, page 22568]. These documents further support GeoSyntec's conclusion that solidification of the North Dike Area wastes is technically infeasible due to the type, size, and heterogeneity of the waste components in that area.

Based on the additional data obtained during the supplemental site investigations, GeoSyntec's evaluation of the solidification component of the original remedy, and the findings presented in this report, GeoSyntec concludes the following:

- solidification of the entire North Dike Area is technically infeasible and should be eliminated from further consideration;
- solidification of certain "hot spots" or localized areas of the North Dike Area may be appropriate if is it evaluated to be necessary as a component of the revised remedy; the practice of isolating or providing special measures for "hot spot" areas is consistent with presumptive remedy directives for CERCLA municipal landfill sites; and
- if solidification is used as a component of a revised remedy for "hot spot" areas, the performance requirements should be evaluated and amended; new performance requirements should be developed that are both implementable and consistent with the engineering requirements of the revised remedy.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Terms of Reference

This document has been prepared by GeoSyntec Consultants, Atlanta, Georgia (GeoSyntec) on behalf of the Bailey Site Settlors Committee (BSSC) to present the results of the supplemental site investigation activities performed in the North Dike Area of the Bailey Superfund Site, located in Orange County, Texas. This work product is the result of Task 4 "*Supplemental North Dike Area Site Investigation and Evaluation of Original Remedy*" of the Focused Feasibility Study (FFS) Work Plan, Revision 1, prepared by GeoSyntec for the BSSC and dated 15 August 1995. The FFS Work Plan was submitted to the U.S. Environmental Protection Agency (USEPA), Region 6, on 15 August 1995. USEPA provided the BSSC with approval to proceed with the Work Plan on 16 August 1995.

Work was performed as outlined in the approved FFS Work Plan, and in accordance with the specific requirements of the following documents:

- Sampling and Analysis Plan for Supplemental Site Investigation for Focused Feasibility Study, Revision 1, (SAPSSI) dated 17 August 1995, and prepared by GeoSyntec;

- Quality Assurance Project Plan (QAPP) prepared by Harding Lawson Associates (HLA), dated October 1991, as amended by Appendix A of the SAPSSI;

- Final Sampling and Analysis Plan (SAP-HLA) prepared by HLA, dated October 1991; and

- Health and Safety Plan (HASP) prepared by Parsons Engineering Science, Inc. (Parsons ES), dated July 1995, and Addenda Number 1 and 2.

1.2 Project Background

The Bailey Superfund Site is located approximately three miles (five km) southwest of Bridge City in Orange County, Texas. The site was originally part of a tidal marsh near the confluence of the Neches River and Sabine Lake. In the early 1950s, Mr. Joe Bailey constructed two ponds (Pond A and Pond B) at the site as part of the Bailey Fish Camp. The ponds were reportedly constructed by dredging the marsh and piling sediments to form dikes along the north and east limits of Pond A (the North Dike Area and the East Dike Area). Between the time of construction (1950s) and the spring of 1971, Mr. Bailey used a variety of wastes (including industrial wastes, municipal solid waste, and construction debris) as fill material for these dikes.

In 1984, the USEPA proposed the site for inclusion on the National Priorities List (NPL). The site was placed on the NPL in 1986. A remedial investigation (RI) was completed for the site in October 1987, and a feasibility study (FS) was completed in April 1988. The RI concluded that: (i) the site has had no impact on drinking water; and (ii) in the unlikely event that any constituents were to migrate in the direction of ground water flow, it would take over 800 years for them to reach potable ground water. The shallow ground water beneath and adjacent to the site is saline and not suitable for human consumption. The closest public water supply well, located approximately 1.5 miles (2.4 km) northeast of the site, is estimated to be approximately 385 ft (117 m) deep. The nearest municipal water supply wells are located approximately 2.6 miles (4.2 km) northeast of the site and have a reported depth of approximately 585 ft (173 m). There has been no development in the project area, nor is it likely to be suitable for future development due to prohibitions against development in wetlands areas. No air emissions above ambient conditions were detected during air monitoring activities conducted during RI field activities.

The FS recommended in-situ solidification of the on-site waste as the preferred remedy for the site. USEPA selected this remedy in its Record of Decision (ROD), signed on 28 June 1988. The remediation area comprises the North Dike Area, East Dike Area, and the North Marsh Area. The North Dike Area is approximately 3,000 ft (914 m) long by 130 ft (40 m) wide, and the East Dike Area is approximately 1,200 ft (366 m) long by 220 ft (67 m) wide. Surficial tarry wastes are present in the North Marsh Area which borders the north side of the North Dike Area. These wastes extend from the edge of the North Dike Area to a distance of up to 150 ft (46 m) into the marsh.

A remedial design (RD) for the above remedy was developed by Harding Lawson Associates, Houston, Texas (HLA) and a construction contract for the implementation of the remedial action (RA) was awarded to Chemical Waste Management, Inc. (Chem Waste) in 1992. During initial attempts to solidify waste in the East Dike Area, Chem Waste encountered numerous difficulties attaining the specified performance parameters for the solidified waste. As a result of the difficulties, the RA was eventually suspended in early 1994. Remedial activities that were completed prior to the cessation of work include the construction of the dike around the East Dike Area of the site, and partial solidification of waste within that area.

After Chem Waste stopped work, the BSSC retained independent contractors and consultants to perform a pilot study to evaluate the feasibility of the selected remedy (i.e., in-situ solidification) at one location in the East Dike Area. The study indicated that solidification could be performed at that location in general conformance with the specifications. The study concluded, however, that to meet the specification requirements, conformance testing needed to be based on wet sampling of uncured material, followed by laboratory curing, rather than coring of material cured in-situ (as had initially been performed). Importantly, the study did not address the feasibility of solidification in other areas of the site. Data and information collected during the RA indicates that the waste in the North Dike Area is deeper and more heterogeneous than the waste in the area of the pilot study. Data obtained during the RA also indicates that waste constituents in the North Dike Area include municipal waste, rubber crumb, and tarry wastes which, based on both USEPA and industry experience, may be difficult and expensive to effectively solidify in-situ. If present in sufficient quantities, these constituents could render in-situ solidification technically infeasible.

Based on RA activities at the site to date, the BSSC concluded that successful site-wide solidification of waste at the site would be, at a minimum, expensive, time consuming, and difficult to implement. Solidification in accordance with the specifications may be technically infeasible in the North Dike Area. Recognizing this fact, USEPA requested that the BSSC further evaluate the feasibility of solidification of the North Dike Area and perform an FFS to identify whether more expedient and effective RA alternatives may be available.

Other reasons for performing the FFS at this time include: (i) developments over the past seven years in the materials and methods used to implement RAs will allow consideration of remedial alternatives not available at the time the original FS was prepared; and (ii) data collected during conduct of the RD and RA have resulted in an improved understanding of subsurface conditions at the site in comparison to the understanding of conditions at the time the original FS was conducted.

1.3 Objectives of the Supplemental Site Investigation

The supplemental site investigation was performed to better define the composition and nature of the waste material in the North Dike Area. Results of the solidification pilot study performed in the East Dike Area indicate that solidification of waste in the North Dike Area may be infeasible due to the composition of waste and its deeper vertical extent in comparison to the East Dike Area waste. The waste composition in the North Dike Area was not well documented, but was reported to contain a higher proportion of tarry materials, municipal solid waste, and rubber crumb than the East Dike Area waste. Effective solidification of all three types of materials could prove difficult, and possibly infeasible. To proceed with the evaluation of the original remedy, and to evaluate potential alternative remedies, it was necessary to better define the composition and nature of the waste material in the North Dike Area.

In the Work Plan for the FFS, it was proposed that a limited number of test pits be excavated in the North Dike Area so that the composition of the disposed waste could be evaluated. The results of the waste composition analysis will be considered during the evaluation of the original remedy, the remedial technology screening process, and the detailed analysis of remedial alternatives. USEPA guidance documents were used to the extent possible to evaluate the feasibility of solidification of waste materials identified through the composition evaluation. This document presents the findings of the supplemental site investigation together with an evaluation of the technical feasibility of in-situ solidification as a remedy for the North Dike Area of the site.

2. OVERVIEW OF PREVIOUSLY OBTAINED NORTH DIKE AREA DATA

2.1 Summary of Previous Investigations

This section of the document presents a brief overview of the various investigation activities performed in the North Dike Area of the site. The section is not intended as an all inclusive summary, but is intended to document the main elements of the work performed to date and to identify the data gaps that lead to the performance of the supplemental site investigation described herein.

Remedial Investigation (RI)

As part of the site remedial investigation (RI), Woodward-Clyde Consultants (WCC) advanced numerous borings into the North Dike Area (referred to as the Waste Channel Area in the RI report). The RI indicates that a total of 66 borings were completed of which 12 were "*individual soil/waste borings and 54 borings were traverse borings completed to identify the limit of the waste.*" Section 4.2.2.1 of the RI states:

> "*Wastes deposited in this area consist of both municipal and industrial wastes, which are commonly intermixed. The municipal waste is comprised of fragments of glass, metal and wood, along with miscellaneous rubble and trash. Glass marbles and rusty material were also noted. The industrial wastes are black and of variable consistency, usually granular and crumbly to rubbery. The material varies from very soft to hard. The waste is occasionally tarry in consistency, particularly along traverse RWCT-15. The industrial waste often is intermixed with municipal waste and/or soil fill, and occasionally interlayered with municipal waste and/or soil fill. Also, the waste is sometimes described as oily; typically, this occurs below the level of groundwater saturation. So, the description "oily" likely reflects increased moisture content rather than a different type of waste material.*"

A review of the RI boring logs and other data (Appendix E of the RI) indicates that jar samples of the waste were taken. The boring logs indicate that in some cases, pocket penetrometer shear strength readings and photoionization detector (PID) readings were taken on the samples. However, it appeared that no attempt was made to evaluate the composition of the waste, other than visual classification of boring samples. The emphasis of the investigation appears to have been on defining the extent of the waste materials (horizontal and vertical), and the nature of any contamination resulting from the waste.

Feasibility Study (FS)

Additional field and laboratory activities were performed during the FS by Engineering-Science, Inc. (now Parsons Engineering Science (Parsons ES)). The focus of the FS was on characterizing the waste for purposes of evaluating certain RA alternatives (solidification, landfilling incineration, deep well injection, and wastewater biological treatment). The FS presented data to demonstrate that solidification of the waste reduced the mobility of waste constituents. Data were also presented to demonstrate improvements in the geotechnical properties of the solidified waste as compared to raw waste samples.

For the FS, Parsons ES performed testing on two composite samples that were identified as being representative of the North Dike Area and East Dike Area. According to Appendix E of the FS, each composite sample was made from discrete borings advanced into the two waste disposal areas. The sample from the North Dike Area (designated "BWC") was composed of discrete samples from fifteen 10- to 12-ft (3 to 3.6 m) deep borings in the North Dike Area while the East Dike Area sample (designated "BEA") was comprised of samples from thirteen 10- to 12-ft (3 to 3.6 m) deep borings in the East Dike Area. The FS states that both hollow stem auger and air rotary drilling methods were employed to advance the borings. Shelby tubes were used to collect samples. Where the waste was too wet or oily to collect with Shelby tubes, the waste was collected from drilling cuttings using a hand trowel.

The FS evaluated the effectiveness of solidification by comparing test results for raw waste to several samples of solidified wastes (using different solidification agents and mix proportions). The evaluation was made using data from toxic characteristic leaching procedure (TCLP) testing (USEPA Method 1311) and geotechnical testing. Geotechnical testing consisted of the following:

- paint filter (USEPA Method 9095);
- moisture content (ASTM D 2216);

- liquid and plastic limits (ASTM D 4318);
- bulk density (ASTM D 2922 or D 2937);
- physical description (ASTM D 2488);
- soil pH (USEPA Method 9045);
- optimum moisture and density (ASTM D 558);
- compressive strength (ASTM D 1632, ASTM D 1633);
- wetting-and-drying durability (ASTM D 559 Method B); and
- permeability (ASTM D 3877).

The FS demonstrated that solidification of the waste samples reduced the mobility of the waste constituents (determined by TCLP testing) and improved the geotechnical properties of the material.

Stabilization Evaluation Report (SER)

An in-situ stabilization evaluation program was a requirement of the Consent Decree. A work plan to meet the requirement was developed and then implemented between August and December 1990 by HLA. The objectives of the evaluation were to:

- further characterize the chemical and physical properties of the site;

- define stabilization sectors and the appropriate stabilization admixtures for each sector; and

- estimate the physical and hydrogeological properties of the North Marsh Area levee for use in the design.

The field investigation program consisted of the following:

- drilling and sampling 11 geotechnical borings adjacent to the waste areas to investigate the engineering properties of surrounding soils for design purposes;

- drilling and sampling 18 borings in the waste areas designated in the RI/FS;

- excavating 15 trenches with a backhoe to augment or supplement waste samples obtained from the borings;

- compositing samples from waste borings and trenches for the subsequent laboratory admixture stabilization evaluation;

- performing 15 cone penetration tests (CPT) in the waste areas to evaluate the effectiveness of the cone as a tool to delineate waste boundaries during remediation; additionally, the cone penetrometer was used to collect geotechnical data necessary for design; and

- performing a field audit to see that the procedures outlined in the work plan and QAPP were being followed, and to identify any required modifications to these procedures.

HLA prepared a Stabilization Evaluation Report (SER) describing the results of the in-situ stabilization evaluation program. According to the SER, bulk samples were taken for visual classification and geotechnical laboratory testing. Most of the waste borings were drilled using a track-mounted drill rig and hollow stem augers. Shelby tube, split-spoon, and bucket type samplers were used to obtain samples for logging purposes. Auger cuttings were collected to provide sufficient volume of sample for the admixture stabilization evaluation.

The SER also addressed the thickness of waste in areas of interest. For example:

"The waste borings indicated an industrial waste thickness as thin as 0.8 feet at HLA-3 in Pit B and as thick as 10.5 feet at HLA-8 north of Pond A. The average depth of waste along the East Side of Pond A was 5.0 feet...."

Fifteen trenches were excavated in both the North Dike Area and the East Dike Area. According to the SER, the trenches were performed to provide additional sample volume for the admixture stabilization evaluation program. Waste profile descriptions, PID readings, and pocket penetrometer measurements were also taken during the trenching.

The SER presents the results of a three-phase evaluation procedure performed by HLA. For the Phase I evaluation, physical and chemical properties of the unstabilized waste were evaluated to provide a baseline for comparison with the properties of the stabilized wastes. During Phase I, three admixture types were evaluated at different dosages (cement, flyash and lime kiln dust). Phase I testing was performed using a pocket penetrometer to assess the potential effectiveness of each admixture. Samples that had an unconfined compressive strength (UCS) equal to or greater than approximately 50 psi (344.7 kPa) after curing for 72 hours, as measured with the pocket penetrometer, were selected for the Phase II evaluation. The UCS criteria was apparently established as 25 psi (172.4 kPa) multiplied by an approximate factor of safety of 2.

Phase II of the testing program consisted of confirming the UCS of the samples that passed the Phase I evaluation using a modified form of ASTM D 1633. The goal was to estimate the amount of admixture required to attain a UCS strength of 25 psi (172.4 kPa).

Phase III of the testing program consisted of evaluating physical properties of the stabilized waste including: UCS (after being immersed in the site ground water for 31 days); moisture content; dry density; and permeability. The summary of the admixture evaluation included the following:

> *"In general, it has been found that the waste at the site can be stabilized with an admixture of 10 to 20 percent cement and meet the minimum strength and permeability requirements with a resulting decrease in mobility of a majority of the metals present. Sample Areas 8 and 9*[1] *were better stabilized when treated with lime kiln dust due to their high oil and grease concentrations."*

The SER also included a literature study of stabilization techniques. Techniques evaluated were as follows:

- inject and mix:
  - shallow soil mixing;
  - track mounted mixing;
- pneumatic spreading;

[1] Sample Area 8 consists of Pit B and the east end of Pit A-3. Sample Area 9 is located east of Pit B.

- closed loop consolidation; and
- excavation/stabilization.

The summary of the literature study included the following:

"The best suited stabilization techniques include inject the mix, and area excavation (excavate, stabilize, and replace). The inject and mix technique is well suited for areas having only small quantities of debris mixed with the waste. Where large amounts of debris are present, area excavation will be required."

2.2 Evaluation of Previous Data and Identification of Data Gaps

The RI report focused on defining the nature and extent of waste present at the site. Identified materials include municipal waste, industrial wastes, rubble, and trash. The RI also indicates the presence of tarry and oil wastes.

The FS focused on the evaluation of potential RA alternatives for the Bailey Superfund Site and included an evaluation of the effectiveness of solidification. Effectiveness was evaluated on the basis of an overall reduction in the mobility of the waste constituents (based on TCLP testing of unsolidified and solidified waste samples), and by improvements to the geotechnical properties (primarily strength and permeability) of the waste.

The in-situ stabilization evaluation program was performed as part of the Remedial Design (RD) effort, and was a requirement of the Consent Decree. The SER presents the findings of the evaluation program. Data gathered during the evaluation program expanded on the FS efforts and was used to support the following:

- evaluation of appropriate admixtures;
- evaluation of in-situ solidification methods;
- evaluation of appropriate QA/QC methods; and
- delineation of various areas of the site that may need special consideration.

An important observation is that all of the above studies were essentially based on samples obtained from borings using split-spoon, Shelby tubes, or small bucket samplers to collect the samples. In some cases, Auger cuttings were added to the samples so that a sufficient amount of material would be available for the stabilization testing. These sampling methods are not effective for collecting samples that contain large-sized waste particles and tarry and liquid wastes. Therefore, the samples had maximum particle sizes on the order of 1 to 2 (2.5 to 5.1 cm) inches in greatest dimension and the sampling methodology would exclude significant portions of debris, municipal solid waste, liquid, and tarry components.

It appears that only limited attempts were made to study or evaluate the physical composition of the waste at a macro-scale (i.e., extent of large items such as debris, cable, wood and metal items that could interfere with in-situ solidification methods). Also, the waste was not adequately evaluated at the micro-scale (i.e., identification of individual components with respect to particle size, percentage composition, and the presence of oil, grease, or other potential solidification inhibitors). A thorough evaluation of both the macro- and micro-composition of the waste is considered to be important with respect to making a complete evaluation of the technical feasibility of in-situ solidification methods. The supplemental site investigation program for the North Dike Area was therefore designed to provide this information.

Also, in evaluating the technical feasibility of the original remedy for the North Dike Area, valuable information can be extrapolated from the efforts that have been made in the East Dike Area of the site. However, it is important to note that previous investigations have concluded that there are significant differences between the North Dike Area and the East Dike Area. Generally, the North Dike Area wastes are deeper than the East Dike Area. Observations also indicate the nature of the waste to be different.

2.3 <u>Previous Remedial Efforts</u>

2.3.1 Overview

As stated above, even though the waste in the North Dike Area differs from the East Dike Area, valuable information can be obtained from a review of previous efforts to solidify the East Dike Area materials. The following sections provide an overview of the previous solidification efforts performed in the East Dike Area and an assessment of the applicability of the available information to the North Dike Area remediation.

2.3.2 Summary of East Dike Area Solidification Efforts

CWM was awarded the construction contract for the implementation of the RA in 1992. This contract included the solidification of both the North Dike Area and the East Dike Area. Numerous difficulties were encountered during the solidification effort that occurred in the southern part of the East Dike Area. This resulted in the suspension of the RA in January 1994, largely due to difficulties in attaining the specified criteria for permeability (measured by testing cores of solidified waste) and strength (measured as UCS). It is important to note that the area of the East Dike that was solidified corresponds approximately to the area referred to as "Sample Area No. 7" in the SER. According to Table 1 of the SER, the waste in the area is described as follows:

"*Black Cindery Waste*
- *saturated, soft*
- *some rubbery chunks, no municipal waste noted*"

Also, according to the waste isopach map (Drawing 2B of the SER), the waste depth in Sample Area No. 7 is typically 3 to 4 ft (0.9 to 1.2 m) deep with localized depressions to approximately 7 ft. (2.1 m). Both the SER and the data obtained from the supplemental site investigation (presented in this report) indicate the North Dike Area to be significantly different with respect to both waste composition and depth.

After the contractor stopped work, the BSSC retained independent contractors and consultants to perform a pilot study. The findings of the pilot study are discussed below.

2.3.3 In-Situ Stabilization Pilot Demonstration

An in-situ pilot demonstration was performed at the Bailey Superfund Site between 19 October and 26 October 1994 (i.e., after suspension of construction activities). The work was performed by independent contractors and consultants, and the findings were presented in a report entitled "*In-Situ Stabilization Pilot Demonstration - Final Report*" [McLaren Hart Environmental Engineering Corporation and Kiber Environmental Services, Inc.].

The executive summary of the report states the following:

"*The field work consisted of the in-situ stabilization of two test sections in material which was deemed representative for the waste areas requiring in-situ stabilization. One area was stabilized with a mixture of cement and bentonite and one area with the addition of 20% cement, the minimum amount required in the initial performance-based Technical Specifications. During this field work a variety of QA/QC measures were taken and documented. The stabilized material was subsequently sampled in the uncured (wet sampling) and cured (hardened) state using various methods. The sampling methods were chosen based on general industry practices, the initial Technical Specifications, and based on methods previously utilized at the Site. Samples obtained from these various methods were then sent to Kiber's laboratory in Atlanta, Georgia.*

Laboratory testing, consisting primarily of unconfined compressive testing and permeability testing, on the various samples obtained from the pilot demonstration. The results of this testing indicated that the wet samples yielded acceptable test results which met the initial Technical Specifications and were consistent with the test results achieved during the bench-scale treatability study which was performed prior to the field work. The test results from the samples obtained in the cured state using drilling techniques yielded unacceptable test results. Visual observations of these samples indicated that these samples had microfractures which in our opinion are due to disturbance during sampling operations. These findings were consistent with our experience, and the experience of others in this field on similar stabilization projects. Further, additional longer term testing of the wet samples and cured samples showed that the wet sample continued to gain strength with time, while the cured samples showed no significant strength gains with time, an indication that these samples have be sufficiently disturbed after initial curing.

Based on the in-situ pilot demonstrations performed by McLaren/Hart and Kiber, review of the Technical Specifications, the experience of McLaren/Hart, Kiber and others in the industry, we have concluded the following:

- *The waste material can be stabilized to the required depths and areal extent, using in-situ technology and non-propriety admixtures, and;*

- *The waste material can be stabilized such that the stabilized material has a minimum unconfined compressive strength of 25 psi and a maximum permeability of 1 x 10^{-6} cm/sec, consistent with the overall intent of the Contract Documents.*

The above conclusions are based on the using wet sampling methods for Contract acceptance. This would require the approval of a sampling modification in accordance with the Field Order or Change Order process.

It is also the opinion of McLaren/Hart and Kiber that the reproducibility of meeting the Technical Specifications during full-scale work is very good. Based on the above conclusions, it is our opinion that no additional in-situ stabilization pilot studies are necessary for the East Waste Disposal Area."

It is important to note that both pilot demonstration areas (Area A and Area B) were located close to the middle of the East Dike Area. Correlating this back to the SER, the locations were approximately the middle point between "Sample Area No. 2" and "Sample Area No. 7" in the SER. Descriptions of the waste at these locations, as presented in the SER, are as follows:

- Sample Area No. 2
  "Black Cindery Waste
  - *dry, soft*
  - *some municipal waste*
  - *soft with gravel size rubbery waste."*

- Sample Area No. 7
  "Black Cindery Waste
  - *saturated, soft*
  - *some rubbery chunks, no municipal waste noted."*

The waste depth at the pilot demonstration areas (maximum difference between the surface and the bottom of the treatment area) was 7.75 ft. (2.4 m). However, the report is not clear as to whether this is the depth of the waste, or the depth that was treated. A review of the waste isopach map of this area (Drawing 2B of the SER) suggests that the waste depth at the pilot area may only be 3 to 5 ft deep (0.9 to 1.5 m).

2.4 Relevance of Pilot Demonstration to North Dike Area

Data gathered during previous studies, together with the data presented in this report, supports the following observations:

- the principal description of East Dike Area waste (as provided by HLA) is "Black Cindery Waste"; HLA only used this description for wastes at the extreme east end of the North Dike Area; generally, HLA described the North Dike Area wastes as:
    - "Industrial and Municipal Waste" (black cindery and rubbery wastes with boards, trees, tires, and appliances),
    - "Black Rubbery Waste" (with tar-like and cindery layers and large amounts of municipal waste), and
    - "Oily Tar-Like Waste";
- the waste material in the North Dike Area likely contains a greater proportion of municipal solid waste, and larger items of debris than the East Dike Area;
- the North Dike Area contains zones of very oily or tarry waste materials that are significantly different to the East Dike Area wastes; and
- generally, the wastes in the North Dike Area are deeper than the wastes in the East Dike Area; waste depths in the North Dike Area can be greater than 10 ft (3 m), whereas, average waste depths in the East Dike Area are approximately 5.0 ft (1.5 m).

3. INVESTIGATION, SAMPLING AND TESTING PROCEDURES

3.1 Test Pit Excavation and Sampling Procedures

Between 22 and 25 August 1995, 13 test pits (designated G-TP1 through G-TP13) were excavated along the North Dike Area, east of Pit B. Ten of the test pit locations (G-TP1 through G-TP9 and G-TP11) were evenly spaced along this portion of the North Dike Area. The locations for test pits G-TP10, G-TP12, and G-TP13 were selected to provide additional waste composition information. G-TP10 was excavated adjacent to G-TP9 because it was believed that the waste composition for the two adjacent areas could be different. Test pit G-TP9 was excavated in a soft, low-lying area that had oily and tarry waste exposed at the ground surface. Test pit G-TP10 was excavated in an area adjacent to G-TP9 that could support the weight of the backhoe and did not have the oily and tarry waste exposed at the ground surface. Test pit G-TP12 was excavated between G-TP1 and G-TP2, and G-TP13 was excavated between G-TP2 and G-TP3. Test pits G-TP12 and G-TP13 were excavated so that the waste composition in the vicinity of G-TP2 could be better evaluated. The test pit locations are shown on Figure 1.

The test pits were excavated with a backhoe and were approximately 3 to 4 ft (0.9 to 1.2 m) wide, 10 ft (3 m) long, and between 4.5 to 13 ft (1.4 to 4 m) deep. The test pits were excavated to a depth at least 1 ft (0.3 m) below the bottom of the waste, except for G-TP9. Test pit G-TP9 was excavated in an area where the waste material had very little strength; therefore, the test pit walls tended to collapse or flow into the open excavation before the waste could be excavated to a depth of one foot below the bottom of the waste material.

The excavated soil and waste material were placed on plastic sheeting down wind from the excavation. Samples of the waste material and the soil beneath the waste were collected from the backhoe bucket with a shovel as the excavation proceeded. A total of 23 bulk waste samples were placed in 5-gallon (18.5-l) plastic buckets for waste characterization analysis. Duplicate waste samples were collected for 14 of the 23 was samples and were placed in 1-gallon (3.7-l) metal or approximately 1-quart (0.9-l) plastic containers for laboratory analysis. In addition, seven soil samples were collected from beneath the waste for laboratory analysis. A summary of the samples collected from the North Dike Area during this supplemental site investigation is included in Table 1.

The walls of the test pits were logged by field personnel standing along the rim of the excavation. No one was permitted to enter the excavations. Field personnel logged the contents of the excavated material regarding the relative amounts of glass, metal, municipal solid waste (MSW) and soil mixture, rubber crumb and soil mixture, soil, wood, pebbles and stone, organic material, and other waste materials. Photographs were taken and a videotape recording was made during the excavation process. Observations made during the test pit excavation activities are discussed in Section 4.1 of this document.

3.2 Testing Procedures

3.2.1 Field Tests

The temperature of three bulk samples was measured in the field following the placement of the bulk samples in the 5-gallon (18.5-l) plastic buckets. Twenty bulk samples or portions of the bulk samples were characterized in the field to evaluate the waste composition for each sample. The following procedures were used to perform this evaluation:

- the weight and volume of each waste characterization sample were recorded on pre-printed waste characterization forms;

- the sample was sorted by particle size using 14-in. (0.36-m) diameter sieves with square openings of 1 in. (25.4 mm), 1/2 in. (12.7 mm), and 1/4 in. (6.4 mm);

- the material remaining on each sieve and passing the 1/4-in. (6.4 mm) sieve was then sorted according to composition: glass, metal, MSW and soil mixture, rubber crumb and soil mixture, soil, wood, pebbles and stone, organic material, and other waste materials; and

- the weight and volume for each composition type and particle size were recorded on the waste characterization forms.

The results of the field tests are presented in Section 4.2.1 of this document.

3.2.2 Laboratory Tests

The 14 waste duplicate samples and the 7 soil samples collected from beneath the waste were shipped to the GeoSyntec Environmental Laboratory in Atlanta, Georgia, for additional analyses. Nine waste samples were tested for loss on ignition (ASTM D 2947) to estimate organic content, percent passing No. 4 U.S. standard sieve size, and moisture content (ASTM D 2216). Six soil samples were tested for the following:

- percent passing No. 200 U.S. standard sieve size (ASTM D 1140);
- Atterberg limits (ASTM D 4318);
- soil classification (ASTM D 2487); and
- hydraulic conductivity (ASTM D 5084) (only three samples tested).

The results of these laboratory analyses are presented in Section 4.2.2 of this document.

4. INVESTIGATION AND TESTING RESULTS

4.1 Test Pit Observations

The following observations were made during the excavation of each test pit:

- overburden thickness,
- depth to bottom of waste,
- depth to ground water,
- description of soil beneath the waste, and
- depth to bottom of test pit, and
- waste composition (percentages of glass, metal, MSW and soil mixture, rubber crumb and soil mixture, rubbery waste, soil, wood, pebbles and stone, organic material, and other waste materials were estimated).

In general, based on visual observations made during the excavation of the test pits, the waste contained varying amounts of the waste type listed below (approximated maximum percentages for any one test pit are also listed):

- broken and unbroken glass bottles: up to 40 percent (up to 30 percent unbroken bottles);
- paper: up to 10 percent;
- metal: up to 60 percent;
- wood: up to 10 percent;
- decomposed MSW and soil mixture: up to 90 percent;
- rubbery waste: up to 20 percent; and
- rubber crumb and soil mixture: up to 100 percent.

The following waste materials were also observed in the excavated waste material: automobile tires; water heater; 55-gallon (208 l) drums; plywood; metal pipe, wire, and metal pieces greater than 2 ft (0.6 m) square; concrete pieces up to 3 ft (0.9 m) in diameter and 3 to 4 in. (76 to 101 mm) thick; and two animal bones (up to approximately 2 ft (0.6 m) long).

The portions of the waste that contained mainly decomposed MSW and soil were generally dark brown in color. As the percentage of rubber crumb and other oily and tarry waste materials increased, the waste became black in color.

The observations for each test pit together with sample descriptions and photographs of the excavated waste material are included in Appendix A.

4.2 Testing Results

4.2.1 Field Tests

Table 2 summarizes the results of the waste characterization analyses performed on the 20 bulk samples collected from the test pits. The characterized waste samples contained varying amounts of the waste types listed below (maximum weight percentages for any one sample are also listed):

- broken glass: up to 38 percent;
- metal: up to 8 percent;
- wood: up to 5 percent;
- decomposed MSW and soil mixture: up to 100 percent;
- oily tar-like waste: up to 100 percent;
- very oily tar-like material: up to 89 percent;
- rubber crumb and soil mixture: up to 100 percent;
- soil: up to 10 percent (could be separated from the waste);

- pebbles and stones: up to 21 percent;
- other organic material (straw): up to 5 percent; and
- gray to black silty clay with some oily/tar stains: up to 100 percent (soil type typically located beneath the waste.

Figures 2 through 6 present waste composition summary charts for each test pit. The data in Table 2 was used to prepare these charts.

4.2.2 Laboratory Tests

The data report for the laboratory tests is included as Appendix B of this document. As shown in Table 1 of Appendix B, the waste samples had the following characteristics:

- moisture content (ASTM D 2216);
- percent passing No. 4 U.S. standard sieve size: 63.6 to 79.7 percent with an average of 87.3 percent; and
- loss on ignition (ASTM D 2947): 4.0 to 51.2 percent with an average of 23.9 percent.

The results of the soil sampling testing program are presented as Table 2 of Appendix B. The soil samples had the following characteristics:

- percent passing No. 200 U.S. standard sieve size: 64.0 to 99.6 percent with an average of 91.75 percent;
- Atterberg limits (ASTM D 4318): liquid limit—35 to 67 percent with an average of 49.5 percent; plastic limit—17 to 32 percent with an average of 23.3 percent; plasticity index—10 to 43 percent with an average of 26.2;
- soil classification (ASTM D 2487): gravelly silt with sand (sample G-TP5-S-1); fat clay (samples G-TP6-S-1, G-TP12-S-1, and G-TP13-S-1); and lean clay (samples G-TP8-S-1 and G-TP11-S-1); and

- hydraulic conductivity (ASTM D 5084): 3.3×10^{-7} to 1.1×10^{-7} cm/sec.

These results will be used during the evaluation of alternative remedies, and are therefore not addressed further in this document.

5. INTERPRETATION OF RESULTS

5.1 Summary of Waste Composition in the North Dike

As shown on Figure 7, the total waste composition by weight for the samples that were characterized is as follows:

- 39 percent rubber crumb and soil mixture;
- 26 percent decomposed MSW and soil mixture;
- 12 percent silty clay (typically located beneath the waste);
- 10 percent glass (broken bottles);
- 8 percent oily tar-like material; and
- 5 percent metal, soil, wood, pebbles/stones, and organics.

Based on the visual observations of the excavated waste material (presented in Section 4.1 of this document), the waste had a higher quantity of metal, wood and glass than indicated by the waste sample characterization results given above. This difference is attributed to the limitations of sorting a sample that is relatively small when compared to: (i) the quantity of material excavated from the test pit; and (ii) the size of the some of the pieces of waste that were excavated from the pits but, due to their size, not included in the sampling and sorting exercise. For example, several test pits had pieces of metal or plywood that were greater than 2 ft (0.6 m) square. A piece of waste this size would not be included in the waste characterization sample, but was considered when relative quantity estimates of the waste composition were made based on visual observations. Therefore, the waste sample characterization results are more applicable for describing the portion of the excavated waste that generally has a particle size less than 2 in. (50 mm) in its greatest dimension. General descriptions of the excavated waste are presented in Table 3. These description were based on: (i) visual observations of the excavated waste; (ii) visual observations of the bulk waste samples; and (iii) the waste characterization results.

Charts showing the percentages of the particle sizes for the rubber crumb and soil mixture, decomposed MSW and soil mixture, and glass are included in Figures 8 through 10 of this document. As shown on the charts, a majority of the sampled rubber crumb and soil mixture (51 percent) and the decomposed MSW and soil mixture (76 percent) had particles that passed the 1/4-in. (6.4 mm) sieve. In contrast, 43 percent of the glass particles were retained on the 1-in. (25.4 mm) sieve.

The results of the supplemental site investigation for the North Dike Area clearly indicate that a variety of municipal and industrial wastes were co-disposed in the area investigated. The results also indicate the presence of large items of debris within the waste matrix.

6. ORIGINAL REMEDY EVALUATION

6.1 Overview

GeoSyntec evaluated the solidification component of the original remedy in accordance with the screening process presented in "*Stabilization/Solidification of CERCLA and RCRA Wastes*" [EPA/625/6-89/022]. A literature review was also conducted and included a review of other USEPA guidance documents, the Federal Register, and various technical papers. The results of the evaluation are presented in this section of the document.

6.2 Results of Screening Process

The USEPA document, "*Stabilization/Solidification of CERCLA and RCRA Wastes*" [USEPA/625/6-89/022] provides a methodology that can be used to screen and evaluate solidification technologies. Section 6.1.1 of the document addresses the screening of wastes, and presents a flow chart (Figure 6-1) that indicates a number of decision points for the rejection of solidification. This flow chart is presented in Appendix C of this document. The first step in the process is to review "Major Waste Characteristics". This evaluation consists of answering questions regarding the characteristics and composition of the waste (responses for the North Dike Area waste are shown in parentheses). Step two evaluates engineering solutions. The process is outlined as follows:

- *Step 1 - Major Waste Characteristics:*
  - Significant amounts of oil/grease? (Yes, in many cases the waste was described as oily or tarry.)
  - Presence of wastes prohibited from landfilling? (Not evaluated in the supplemental site investigation.)
  - Waste not readily mixable (gummy/viscous)? (Yes, large quantities of gummy, viscous, rubbery, tar-like material.)
  - Significant amounts of highly volatile organic materials? (Yes, as evidenced by organic vapor readings, and previous waste analyses.)

- Presence of certain types of debris? (Yes, significant quantities of debris (e.g., wood, metal, cable, glass, tires, drums).)

- High water content in waste? (Yes, often described as saturated.)

- *Step 2 - Available Engineering Solutions:*
  - Oil/water separation? (Not viable)
  - Filtering/screening debris? (Could be viable in an ex-situ process, but would be difficult and expensive.)
  - Chemical/physical pretreatment? (May only be viable for localized areas (e.g., Pit B).)
  - Dewatering the waste? (Not viable).

Based on the above criteria, a solidification remedy should be rejected at this stage on the grounds of technical infeasibility.

6.3 Results of Literature Review

The literature review yielded the following results:

Presumptive Remedy for CERCLA Municipal Landfill Sites [USEPA 540-F-93-035]

In September 1993, USEPA issued this directive that establishes containment as an appropriate response action or presumptive remedy for CERCLA municipal landfills. The following language is taken from the directive:

"*Section 300.430(a)(iii)(B) of the NCP contains the expectation that engineering controls, such as containment, will be used for waste that poses a relatively low long-term threat or where treatment is impracticable. The preamble to the NCP identifies municipal landfills as a type of site where treatment of the waste may be impracticable because of the size and heterogeneity of the contents (55 FR 8704). Waste in CERCLA landfills usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial* *and/or hazardous waste. Because treatment usually is impracticable, USEPA generally considers containment to be the appropriate response action, or the "presumptive remedy," for the source areas of municipal landfill sites.*

The presumptive remedy for CERCLA municipal landfill sites relates primarily to containment of the landfill mass and collection and/or treatment of landfill gas. In addition, measures to control landfill leachate, affected ground water at the perimeter of the landfill, and/or upgradient ground-water that is causing saturation of the landfill mass may be implemented as part of the presumptive remedy."

Components of a presumptive remedy for a municipal landfill may include one or more of the following:

- landfill cap;
- source area ground-water control to contain plume;
- leachate collection and treatment;
- landfill gas collection and treatment; and
- institutional controls to supplement engineering controls.

Only components from the above list that are necessary need be included as part of the remedy for a specific site. The data presented in this report demonstrates that both municipal and industrial wastes were co-disposed at the site. Therefore, the presumptive remedy presented above is applicable to the Bailey Superfund Site.

40 CFR, June 1, 1990, page 22568

This section of the Federal Register includes a discussion of treatment standards for lead wastes. In addressing this issue, it is evident that the Agency considers that organics interfere with the stabilization process particularly when the organic concentrations exceed 1 percent TOC. This conclusion was printed in 40 CFR stating, "*This is primarily because organics typically interfere with the conventional stabilization processes particularly at concentrations exceeding 1% TOC.*" Laboratory tests (loss on ignition) indicate that organic content of the North Marsh Area waste significantly exceeds 1% TOC.

Although significant developments have been made in the past several years with respect to the use of proprietary reagents, sorbents and organophilic clays, the data presented in this report indicates that other items such as large pieces of debris would likely be problematic, even if these reagents were used in areas containing high quantities of organic constituents.

7. SUMMARY OF FINDINGS

7.1 Overview

The findings presented in this section are the opinions of GeoSyntec and are based on: (i) a thorough review of previous studies and data; and (ii) the new data obtained during the supplemental site investigation activities.

7.2. North Dike Area Waste Composition

Based on a review of the previous data, the wastes at the Bailey site, particularly those present in the North Dike Area, were not sufficiently characterized to adequately evaluate the feasibility of solidification for the North Dike Area waste. Previous investigations did not adequately address the following:

- the waste composition at the micro-scale;
- the extent of large items of debris (macro-scale); and
- the organic content of the waste.

Based on the data gathered during the supplemental site investigation, the waste samples collected from the North Dike Area had an approximate gross composition (by weight) of: 39% rubber crumb and soil; 26% decomposed MSW and soil; 12% silty clay; 10% glass; 8% oily tar-like material; and 5% metal, soil, wood, pebbles, and organics. Visual observation of the test pit excavations indicated that the actual quantity of metal, wood, and glass is higher than represented by the bulk samples. This is attributed to sample sorting limitations and to difficulties in obtaining representative samples when the component sizes range from less than 1/4 in. (6.4 mm) to greater than 2 ft (0.6 m) square. Also, based on the results of loss on ignition tests performed on selected waste samples, the total organic content of the waste varied from 4% to 51%. This high organic content of the waste is further supported by waste descriptions, i.e., "oily," "very oily," or "tar-like," and by the presence of decomposed municipal waste.

Based on the results of the supplemental site investigation, a variety of municipal and industrial wastes were co-disposed in the area investigated. These wastes include a high proportion of large items of debris and have a high organic content.

7.3 Feasibility of Solidification of North Dike Area Wastes

Solidification was a required component of the original remedy. Based on an evaluation of the solidification component, GeoSyntec concludes that this component of the original remedy is technically infeasible and is not implementable for the majority of the North Dike Area wastes. The solidification component of the remedy was evaluated on the basis of various USEPA guidance documents, and with respect to accepted industry practice. An evaluation of the solidification component of the original remedy in accordance with the screening process presented in "*Stabilization/ Solidification of CERCLA and RCRA Wastes*" [EPA/625/6-89/022] yielded the following results:

- the major waste characteristics render the waste unacceptable for solidification without applying engineering solutions to remove problematic waste components; and
- potential engineering solutions to remove problematic waste components are generally not viable for the North Dike Area wastes.

Based on "*Presumptive Remedy for CERCLA Municipal Landfill Sites*" [EPA 540-F-93-035], USEPA recognizes the difficulties associated with the treatment of municipal wastes because of the size and heterogeneity of the waste components. Therefore, the presumptive remedy of containment was established for CERCLA municipal landfill sites. GeoSyntec considers this presumptive remedy to be applicable to the Bailey Site due to the presence of significant quantities of municipal waste and due to the documented variation in size and heterogeneity of the waste components.

Based on a review of information presented in 40 CFR, 1 June 1990, USEPA also recognizes that "*organics typically interfere with the conventional stabilization processes, particularly at concentrations exceeding 1% TOC.*" Analyses performed on selected waste samples indicate a total organic content (determined by loss on ignition) of 4% to 51% for the North Dike Area wastes. Therefore, solidification of the organic component in itself is problematic.

In their report on the in-situ pilot demonstration program for the East Dike Area, McLaren Hart and Kiber recommended a modification to the acceptance criteria for in-situ solidification. This would involve determining acceptance based on the collection of wet samples that would be cured and laboratory tested for permeability. Although this procedure may alleviate some problems associated with the solidification of certain areas of the East Dike Area, this change would not address the infeasibility of solidification in the North Dike Area, since this is related to the type, size, and heterogeneity of the waste components in that area.

Considering all of the data available on the North Dike Area, and the evaluation conducted on the solidification component of the original remedy, GeoSyntec concludes that solidification of the North Dike Area waste is technically infeasible.

7.4 Independent Professional Opinion on Supplemental Site Investigation Data

GeoSyntec retained Kiber to provide an independent professional opinion regarding the feasibility of stabilization/solidification of the North Dike Area wastes. The results of Kiber's evaluation are documented in their technical memorandum presented as Appendix D to this report. Kiber's conclusion states the following:

> *"In summary, Kiber feels that the original feasibility study lacked the detail and focus required to adequately assess the feasibility of stabilization and containment once identified as the preferred remedy. The supplemental site investigation performed by GeoSyntec clearly shows that the materials present in the North Dike Area are not amenable to effective stabilization treatment using either in situ or ex situ processes. In situ and ex situ stabilization treatment cannot be practically implemented given the large quantity of oversized wood, glass, metal fragments and rubber/tar. However, selective stabilization treatment is recommended for the portions of the Pit B area."*

8. CONCLUSIONS

Based on the additional data obtained during the supplemental site investigations, GeoSyntec's evaluation of the solidification component of the original remedy, and the findings presented in this report, GeoSyntec concludes the following:

- solidification of the entire North Dike Area is technically infeasible and should be eliminated from further consideration;
- solidification of certain "hot spots" or localized areas of the North Dike Area may be appropriate if is it evaluated to be necessary as a component of the revised remedy; the practice of isolating or providing special measures for "hot spot" areas is consistent with presumptive remedy directives for CERCLA municipal landfill sites; and
- if solidification is used as a component of a revised remedy for "hot spot" areas, the performance requirements should be evaluated and amended; new performance requirements should be developed that are both implementable and consistent with the engineering requirements of the revised remedy.

TABLES

TABLE 1
SUMMARY OF COLLECTED SAMPLES
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

Test Pit	Sample Identification	Sample Type	Sample Depth (feet)
G-TP1	G-TP1-W-1	Waste	5.0
	G-TP1-W-2	Waste	7.5
G-TP2	G-TP2-W-1	Waste	5.5
	G-TP2-W-2	Waste	10.0
G-TP3	G-TP3-W-1	Waste	5.0
	G-TP3-W-2	Waste	7 0
G-TP4	G-TP4-W-1	Waste	4.0
	G-TP4-W-2	Waste	5.0
G-TP5	G-TP5-W-1	Waste	5.0
	G-TP5-W-2	Waste	10.0 to 11.0
	G-TP5-S-1	Soil beneath waste	11.0 to 12.0
G-TP6	G-TP6-W-1	Waste	5.0
	G-TP6-W-2	Waste	10.0
	G-TP6-W-2	Waste	11.0 to 12.0
G-TP7	G-TP7-W-1	Waste	5.0
	G-TP7-W-2	Waste	8.0
	G-TP7-S-1	Soil beneath waste	9.0
G-TP8	G-TP8-W-1	Waste	5.0
	G-TP8-W-2	Waste	6.0 to 7.0
	G-TP8-S-1	Soil beneath waste	7.0 to 8.0
G-TP9	G-TP9-W-1	Waste	0.0 to 4.0
G-TP10	G-TP10-W-1	Waste	4.0 to 5.0
G-TP11	G-TP11-W-1	Waste	4.0 to 5.0
	G-TP11-S-1	Soil beneath waste	5.0 to 6.0
G-TP12	G-TP12-W-1	Waste	5.5 to 6.0
	G-TP12-W-2	Waste	6.5
	G-TP12-S-1	Soil	7.0 to 8.0
G-TP13	G-TP13-W-1	Waste	5.0 to 6.0
	G-TP13-S-1	Soil beneath waste	8.5 to 9.0

TABLE 2
WASTE CHARACTERIZATION RESULTS
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

Sample No.		G-TP1-W-1		G-TP1-W-2		G-TP2-W-1		G-TP2-W-2		G-TP3-W-1		G-TP3-W-2	
Sample Depth (feet)			5.0		7.5		5.5		10.0		5.0		7.0
Total Weight (lbs): bulk/sum of fractions		19.50	20.00	20.00	20.00	15.50	16.00	15.00	15.50	19.50	19.00	23.00	21.50
Total Volume (gal): bulk/ sum of fractions		2.25	2.27	1.67	1.67	2.50	2.58	2.25	2.72	2.50	2.33	2.50	2.50
Glass > 1"	Weight (lbs)	1.75											
1/2" < Glass < 1"	Weight (lbs)	0.75											
1/4" < Glass < 1/2"	Weight (lbs)	1.00											
Glass < 1/4"	Weight (lbs)	0.00											
Total Glass	Weight (lbs)	3.50	18%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.30	13%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Metal > 1"	Weight (lbs)	1.00											
1/2" < Metal < 1"	Weight (lbs)	0.00											
1/4" < Metal < 1/2"	Weight (lbs)	0.00											
Metal < 1/4"	Weight (lbs)	0.00											
Total Metal	Weight (lbs)	1.00	5%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.17	7%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
MSW/Soil > 1"	Weight (lbs)	1.00											
1/2" < MSW/Soil < 1"	Weight (lbs)	1.00											
1/4" < MSW/Soil < 1/2"	Weight (lbs)	1.00											
MSW/Soil < 1/4"	Weight (lbs)	11.00											
Total MSW/Soil	Weight (lbs)	14.00	70%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	1.60	71%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Rubber/Soil > 1"	Weight (lbs)					11.00		13.00		6.00		0.25	
1/2" < Rubber/Soil < 1"	Weight (lbs)					1.00		1.00		3.00		0.25	
1/4" < Rubber/Soil < 1/2"	Weight (lbs)					1.00		0.50		5.00		0.50	
Rubber/Soil < 1/4"	Weight (lbs)					3.00		1.00		5.00		20.50	
Total Rubber/Soil	Weight (lbs)	0.00	0%	0.00	0%	16.00	100%	15.50	100%	19.00	100%	21.50	100%
	Volume (gal)	0.00	0%	0.00	0%	2.58	100%	2.72	100%	2.33	100%	2.50	100%
Soil > 1"	Weight (lbs)	1.00											
1/2" < Soil < 1"	Weight (lbs)	0.00											
1/4" < Soil < 1/2"	Weight (lbs)	0.50											
Soil < 1/4"	Weight (lbs)	0.00											
Total Soil	Weight (lbs)	1.50	8%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.20	9%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Wood > 1"	Weight (lbs)												
1/2" < Wood < 1"	Weight (lbs)												
1/4" < Wood < 1/2"	Weight (lbs)												
Wood < 1/4"	Weight (lbs)												
Total Wood	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Plebbles/Stone > 1"	Weight (lbs)												
1/2" < Pebbles/Stone < 1"	Weight (lbs)												
1/4" < Pebbles/Stone < 1/2"	Weight (lbs)												
Pebbles/Stone < 1/4"	Weight (lbs)												
Total Pebbles/Stone	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Gray to Black Silty Clay	Weight (lbs)	0.00	0%	19.00	95%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
with some Tar/Oil	Volume (gal)	0.00	0%	1.34	80%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Organic (Straw)	Weight (lbs)	0.00	0%	1.00	5%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.33	20%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Gray to Black Viscous	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Oily Tar-like Material	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Gray to Black Viscous Very	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Oily Tar-like Material	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Notes:													

Samples sorted by BDJ and RND.
Data reduced by DBW.
Table checked by RND on 9/6/95 and 9/7/95.

GeoSyntec Consultants

TABLE 2 (Continued)
WASTE CHARACTERIZATION RESULTS
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

Sample No.		G-TP4-W-1		G-TP4-W-2		G-TP5-W-1		G-TP5-W-2		G-TP6-W-1		G-TP6-W-2	
Sample Depth (feet)			4.0		5.0		5.0	10.0 to 11.0			5.0		10.0
Total Weight (lbs): bulk/sum of fractions		21.50	20.00	15.00	15.00	11.00	10.00	10.00	10.00	11.00	10.50	8.00	8.25
Total Volume (gal): bulk/ sum of fractions		2.50	1.37	0.75	0.75	1.13	1.00	0.88	1.15	0.88	0.67	0.75	0.83
Glass > 1"	Weight (lbs)	2.00				0.25		0.25		1.50		1.50	
1/2" < Glass < 1"	Weight (lbs)	1.00				1.75		0.00		1 00		0.50	
1/4" < Glass < 1/2"	Weight (lbs)	1.00				0.00		0.00		1.50		0.25	
Glass < 1/4"	Weight (lbs)	2.00				0.00		0.00		0.00		0.00	
Total Glass	Weight (lbs)	6.00	30%	0.00	0%	2.00	20%	0.25	3%	4.00	38%	2.25	27%
	Volume (gal)	0.50	37%	0.00	0%	0.13	13%	0.05	4%	0.33	50%	0.33	40%
Metal > 1"	Weight (lbs)												
1/2" < Metal < 1"	Weight (lbs)												
1/4" < Metal < 1/2"	Weight (lbs)												
Metal < 1/4"	Weight (lbs)												
Total Metal	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
MSW/Soil > 1"	Weight (lbs)							0.25		0.00			
1/2" < MSW/Soil < 1"	Weight (lbs)							0.00		0.00			
1/4" < MSW/Soil < 1/2"	Weight (lbs)							0.00		0.00			
MSW/Soil < 1/4"	Weight (lbs)							0.00		6.50			
Total MSW/Soil	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.25	3%	6.50	62%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.05	4%	0.33	50%	0.00	0%
Rubber/Soil > 1"	Weight (lbs)	1.00				1.00		0.25				0.50	
1/2" < Rubber/Soil < 1"	Weight (lbs)	0.00				0.75		0.25				0.50	
1/4" < Rubber/Soil < 1/2"	Weight (lbs)	3.00				0.50		0.00				1.00	
Rubber/Soil < 1/4"	Weight (lbs)	8.00				5.75		8.50				4.00	
Total Rubber/Soil	Weight (lbs)	12.00	60%	0.00	0%	8.00	80%	9.00	90%	0.00	0%	6.00	73%
	Volume (gal)	0.67	49%	0.00	0%	0.88	88%	1.00	87%	0.00	0%	0.50	60%
Soil > 1"	Weight (lbs)	0.00											
1/2" < Soil < 1"	Weight (lbs)	0.00											
1/4" < Soil < 1/2"	Weight (lbs)	0.00											
Soil < 1/4"	Weight (lbs)	2.00											
Total Soil	Weight (lbs)	2.00	10%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.20	15%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Wood > 1"	Weight (lbs)							0.25					
1/2" < Wood < 1"	Weight (lbs)							0.25					
1/4" < Wood < 1/2"	Weight (lbs)							0.00					
Wood < 1/4"	Weight (lbs)							0.00					
Total Wood	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.50	5%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.05	4%	0.00	0%	0.00	0%
Plebbles/Stone > 1"	Weight (lbs)												
1/2" < Pebbles/Stone < 1"	Weight (lbs)												
1/4" < Pebbles/Stone < 1/2"	Weight (lbs)												
Pebbles/Stone < 1/4"	Weight (lbs)												
Total Pebbles/Stone	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Gray to Black Silty Clay	Weight (lbs)	0.00	0%	15.00	100%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
with some Tar/Oil	Volume (gal)	0.00	0%	0.75	100%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Organic (Straw)	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Gray to Black Viscous	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Oily Tar-like Material	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Gray to Black Viscous Very	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Oily Tar-like Material	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Notes:													

Samples sorted by BDJ and RND.
Data reduced by DBW.
Table checked by RND on 9/6/95 and 9/7/95.

GEOSYNTEC CONSULTANTS

TABLE 2 (Continued)
WASTE CHARACTERIZATION RESULTS
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

Sample No.		G-TP6-W-3		G-TP7-W-1		G-TP7-W-2		G-TP8-W-1		G-TP8-W-2		G-TP9-W-1	
Sample Depth (feet)		11.5 to 12.0			5.0		8.0		5.0	6.0 to 7.0		0.0 to 4.0	
Total Weight (lbs): bulk/sum of fractions		13.00	13.00	11.00	10.75	12.00	10.75	13.00	11.25	11.00	12.00	13.00	13.00
Total Volume (gal): bulk/ sum of fractions		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.05	0.88	0.80	1.25	1.25
Glass > 1"	Weight (lbs)			1.50				0.50		1.00			
1/2" < Glass < 1"	Weight (lbs)			1.00				1.00		0.50			
1/4" < Glass < 1/2"	Weight (lbs)			0.50				0.50		0.50			
Glass < 1/4"	Weight (lbs)			0.00				0.00		0.00			
Total Glass	Weight (lbs)	0.00	0%	3.00	28%	0.00	0%	2.00	18%	2.00	17%	0.00	0%
	Volume (gal)	0.00	0%	0.25	25%	0.00	0%	0.13	12%	0.20	25%	0 00	0%
Metal > 1"	Weight (lbs)	6 inch piece		0.50				0.25		1.00			
1/2" < Metal < 1"	Weight (lbs)	(separated from		0.00				0.00		0.00			
1/4" < Metal < 1/2"	Weight (lbs)	the sample)		0.25				0.00		0.00			
Metal < 1/4"	Weight (lbs)			0.00				0.00		0.00			
Total Metal	Weight (lbs)	0.00	0%	0.75	7%	0.00	0%	0.25	2%	1.00	8%	0.00	0%
	Volume (gal)	0.00	0%	0.13	13%	0.00	0%	0.05	5%	0.10	13%	0.00	0%
MSW/Soil > 1"	Weight (lbs)	0.00		0.00		2.25		2.00		1.00			
1/2" < MSW/Soil < 1"	Weight (lbs)	0.00		0.00		1.25		1.00		1.00			
1/4" < MSW/Soil < 1/2"	Weight (lbs)	0.00		0.00		0.00		1.00		0.50			
MSW/Soil < 1/4"	Weight (lbs)	13.00		3.00		5.00		4.00		6.50			
Total MSW/Soil	Weight (lbs)	13.00	100%	3.00	28%	8.50	79%	8.00	71%	9.00	75%	0.00	0%
	Volume (gal)	1.00	100%	0.25	25%	0.75	75%	0.75	71%	0.50	63%	0.00	0%
Rubber/Soil > 1"	Weight (lbs)			1.00									
1/2" < Rubber/Soil < 1"	Weight (lbs)			0.25									
1/4" < Rubber/Soil < 1/2"	Weight (lbs)			0.75									
Rubber/Soil < 1/4"	Weight (lbs)			0.00									
Total Rubber/Soil	Weight (lbs)	0.00	0%	2.00	19%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.25	25%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Soil > 1"	Weight (lbs)												
1/2" < Soil < 1"	Weight (lbs)												
1/4" < Soil < 1/2"	Weight (lbs)												
Soil < 1/4"	Weight (lbs)												
Total Soil	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Wood > 1"	Weight (lbs)	1 inch piece											
1/2" < Wood < 1"	Weight (lbs)	(separated from											
1/4" < Wood < 1/2"	Weight (lbs)	the sample)											
Wood < 1/4"	Weight (lbs)												
Total Wood	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Plebbles/Stone > 1"	Weight (lbs)			1.50		0.00		1.00					
1/2" < Pebbles/Stone < 1"	Weight (lbs)			0.00		0.00		0.00					
1/4" < Pebbles/Stone < 1/2"	Weight (lbs)			0.50		2.25		0.00					
Pebbles/Stone < 1/4"	Weight (lbs)			0.00		0.00		0.00					
Total Pebbles/Stone	Weight (lbs)	0.00	0%	2.00	19%	2.25	21%	1.00	9%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.13	13%	0.25	25%	0.13	12%	0.00	0%	0.00	0%
Gray to Black Silty Clay	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
with some Tar/Oil	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Organic (Straw)	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Gray to Black Viscous	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	13.00	100%
Oily Tar-like Material	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	1.25	100%
Gray to Black Viscous Very	Weight (lbs)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Oily Tar-like Material	Volume (gal)	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Notes:													

Samples sorted by BDJ and RND.
Data reduced by DBW.
Table checked by RND on 9/6/95 and 9/7/95.

GeoSyntec Consultants

TABLE 2 (Continued)
WASTE CHARACTERIZATION RESULTS
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

Sample No.		G-TP10-W-1		G-TP11-W-1		TOTAL WEIGHT		PERCENT
Sample Depth (feet)		4.0 to 5.0		4.0 to 5.0		Bulk	Sum	OF TOTAL
Total Weight (lbs): bulk/sum of fractions		9.00	9.00	12.00	11.25	283.00	276.75	100%
Total Volume (gal): bulk/ sum of fractions		0.75	0.75	0.88	0.85	28.30	27.54	100%
Glass > 1"	Weight (lbs)	1.00		0.25			11.50	
1/2" < Glass < 1"	Weight (lbs)	0.00		0.50			8.00	
1/4" < Glass < 1/2"	Weight (lbs)	0.00		0.00			5.25	
Glass < 1/4"	Weight (lbs)	0.00		0.00			2.00	
Total Glass	Weight (lbs)	1.00	11%	0.75	7%		26.75	10%
	Volume (gal)	0.13	17%	0.10	12%		2.44	9%
Metal > 1"	Weight (lbs)						2.75	
1/2" < Metal < 1"	Weight (lbs)						0.00	
1/4" < Metal < 1/2"	Weight (lbs)						0.25	
Metal < 1/4"	Weight (lbs)						0.00	
Total Metal	Weight (lbs)	0.00	0%	0.00	0%		3.00	1%
	Volume (gal)	0.00	0%	0.00	0%		0.44	2%
MSW/Soil > 1"	Weight (lbs)			2.00			8.50	
1/2" < MSW/Soil < 1"	Weight (lbs)			1.00			5.25	
1/4" < MSW/Soil < 1/2"	Weight (lbs)			1.50			4.00	
MSW/Soil < 1/4"	Weight (lbs)			6.00			55.00	
Total MSW/Soil	Weight (lbs)	0.00	0%	10.50	93%		72.75	26%
	Volume (gal)	0.00	0%	0.75	88%		5.98	22%
Rubber/Soil > 1"	Weight (lbs)						34.00	
1/2" < Rubber/Soil < 1"	Weight (lbs)						7.00	
1/4" < Rubber/Soil < 1/2"	Weight (lbs)						12.25	
Rubber/Soil < 1/4"	Weight (lbs)						55.75	
Total Rubber/Soil	Weight (lbs)	0.00	0%	0.00	0%		109.00	39%
	Volume (gal)	0.00	0%	0.00	0%		13.43	49%
Soil > 1"	Weight (lbs)						1.00	
1/2" < Soil < 1"	Weight (lbs)						0.00	
1/4" < Soil < 1/2"	Weight (lbs)						0.50	
Soil < 1/4"	Weight (lbs)						2.00	
Total Soil	Weight (lbs)	0.00	0%	0.00	0%		3.50	1%
	Volume (gal)	0.00	0%	0.00	0%		0.40	1%
Wood > 1"	Weight (lbs)						0.25	
1/2" < Wood < 1"	Weight (lbs)						0.25	
1/4" < Wood < 1/2"	Weight (lbs)						0.00	
Wood < 1/4"	Weight (lbs)						0.00	
Total Wood	Weight (lbs)	0.00	0%	0.00	0%		0.50	0%
	Volume (gal)	0.00	0%	0.00	0%		0.05	0%
Plebbles/Stone > 1"	Weight (lbs)						2.50	
1/2" < Pebbles/Stone < 1"	Weight (lbs)						0.00	
1/4" < Pebbles/Stone < 1/2"	Weight (lbs)						2.75	
Pebbles/Stone < 1/4"	Weight (lbs)						0.00	
Total Pebbles/Stone	Weight (lbs)	0.00	0%	0.00	0%		5.25	2%
	Volume (gal)	0.00	0%	0.00	0%		0.50	2%
Gray to Black Silty Clay	Weight (lbs)	0.00	0%	0.00	0%		34.00	12%
with some Tar/Oil	Volume (gal)	0.00	0%	0.00	0%		2.09	8%
Organic (Straw)	Weight (lbs)	0.00	0%	0.00	0%		1.00	0%
	Volume (gal)	0.00	0%	0.00	0%		0.33	1%
Gray to Black Viscous	Weight (lbs)	0.00	0%	0.00	0%		13.00	5%
Oily Tar-like Material	Volume (gal)	0.00	0%	0.00	0%		1.25	5%
Gray to Black Viscous Very	Weight (lbs)	8.00	89%	0.00	0%		8.00	3%
Oily Tar-like Material	Volume (gal)	0.63	83%	0.00	0%		0.63	2%
Notes:		2 animal bones						
		in bulk sample						

Samples sorted by BDJ and RND.
Data reduced by DBW.
Table checked by RND on 9/6/95 and 9/7/95.

GeoSyntec Consultants

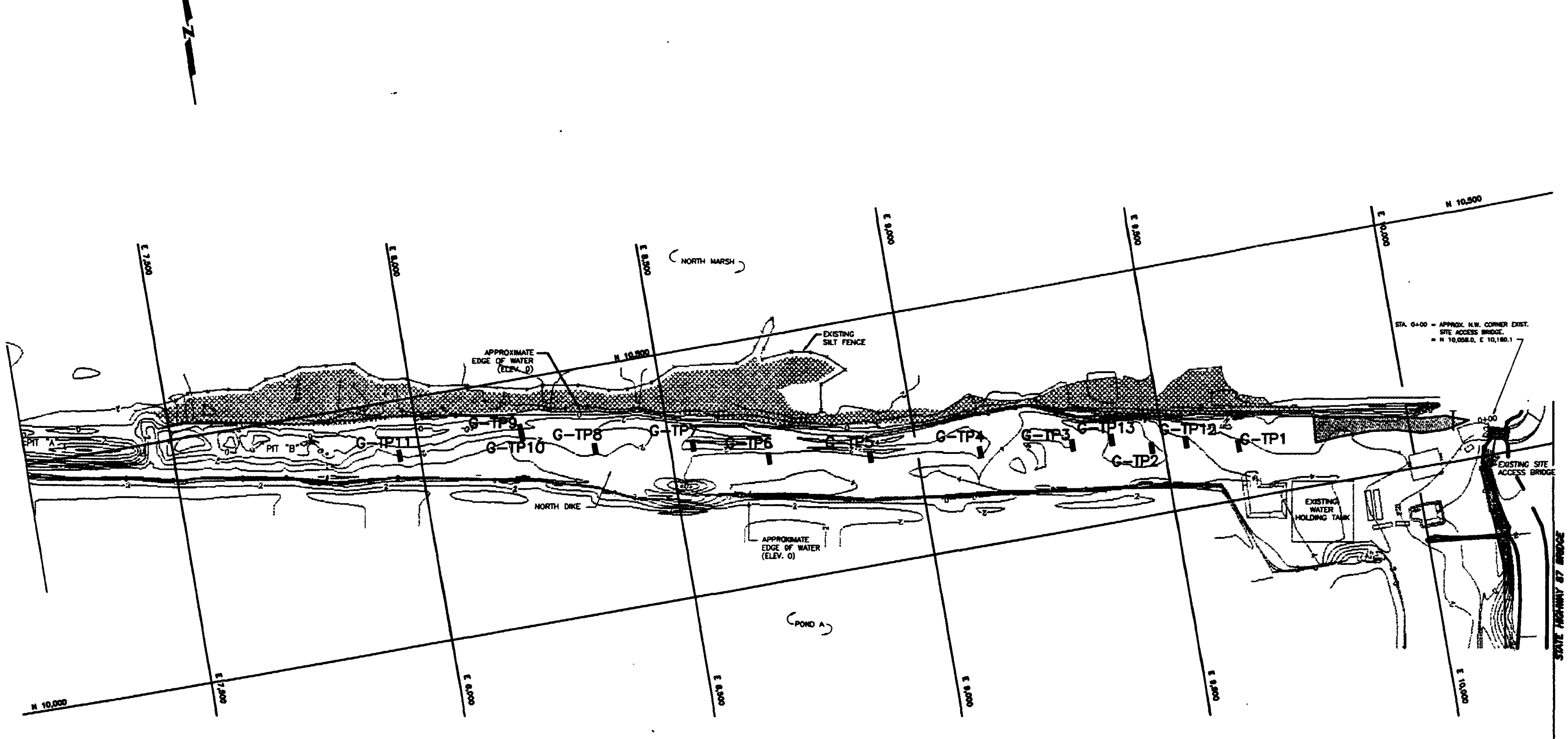
TABLE 3
GENERAL DESCRIPTIONS OF EXCAVATED WASTE
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

Test Pit	General Decription (1)	Comments
G-TP1	MSW and Soil Mixture with Rubber Crumb and Rubbery Waste	Quantity of rubber wastes increased as depth increased
G-TP2	Rubber Crumb and Soil Mixture with Rubbery Waste	
G-TP3	Rubber Crumb and Soil Mixture	
G-TP4	Rubber Crumb and Soil Mixture with MSW	MSW: metal, paper, glass, wood, 2 tires
G-TP5	Rubber Crumb and Soil Mixture with MSW and Rubbery Waste	MSW: metal, glass, tire, 55-gallon drum
G-TP6	Rubber Crumb and Soil Mixture with MSW	MSW: metal, glass, wood, large metal pieces
G-TP7	MSW and Soil Mixture with Rubber Crumb	MSW: metal, glass, wood, water heater, 55-gallon drum, metal pipes, large metal pieces, plywood
G-TP8	MSW and Soil Mixture	MSW: metal, glass, wood, large metal pieces, wire, metal pipe
G-TP9	Oily Tar-like Material with MSW	MSW: metal pipe, unbroken glass bottles, plywood
G-TP10	Very Oily Tar-like Material with MSW	MSW: metal, unbroken glass bottles, metal pipe
G-TP11	MSW and Soil Mixture with Rubber Crumb	MSW: metal, glass, wood, metal pipe, wire, large metal pieces
G-TP12	MSW and Soil Mixture with Rubber Crumb	MSW: metal, glass, wood; quantity rubber crumb increased as depth increased
G-TP13	MSW and Soil Mixture with Rubber Crumb	Quantity of rubber crumb increased as depth increased

Notes:
1. Description based on visual observations of excavated waste, visual observations of bulk waste samples, and the waste characterization results.

FIGURES

TEST PIT LOCATIONS
SUPPLEMENTAL SITE INVESTIGATION – NORTH DIKE AREA
BAILEY SUPERFUND SITE



LEGEND

G-TP6 :DESIGNATION AND APPROXIMATE LOCATION OF TEST PIT

:NORTH MARSH WASTE

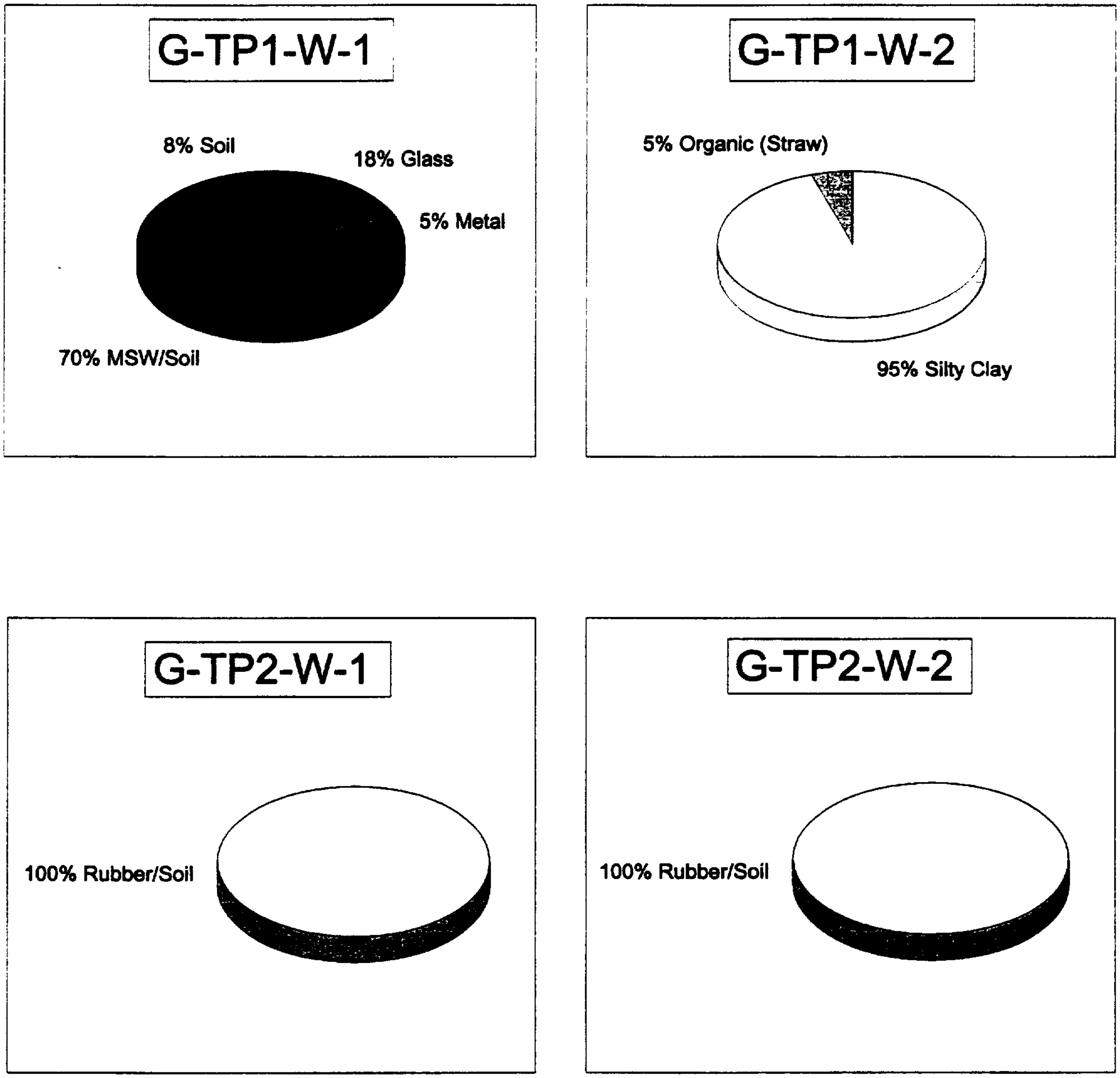
NOTES:

BASE MAP PREPARED BY HARDING LAWSON ASSOCIATES, HOUSTON, TEXAS.

GEOSYNTEC CONSULTANTS
ATLANTA, GA

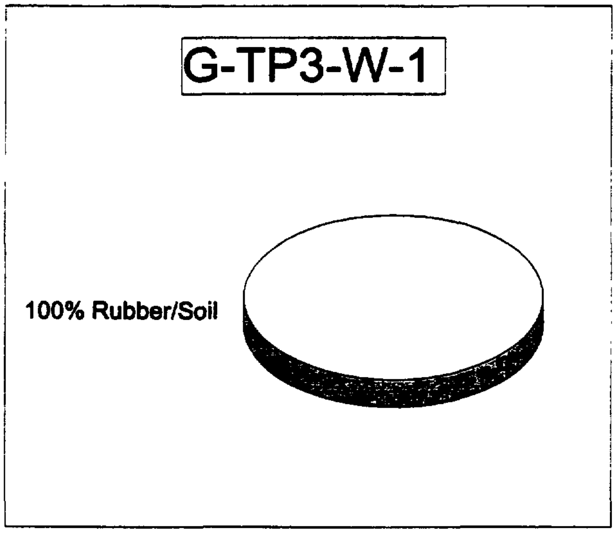
PROJECT NO.	GA3913-04	FIGURE NO.	FIGURE 1
DOCUMENT NO.	GA951149	FILE NO.	3913-001

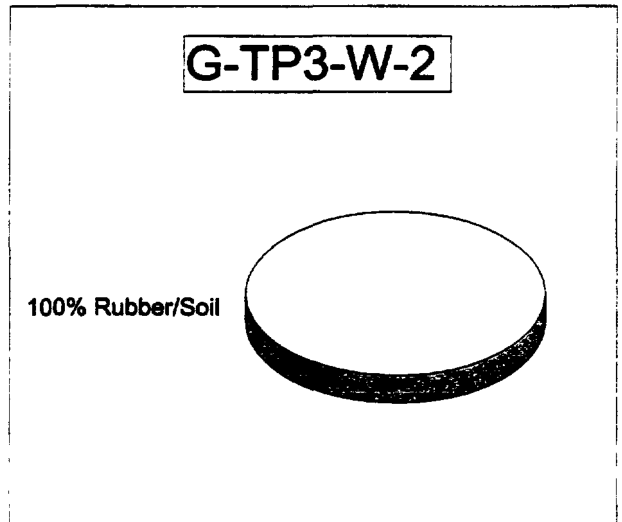
FIGURE 2
SAMPLE COMPOSITION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

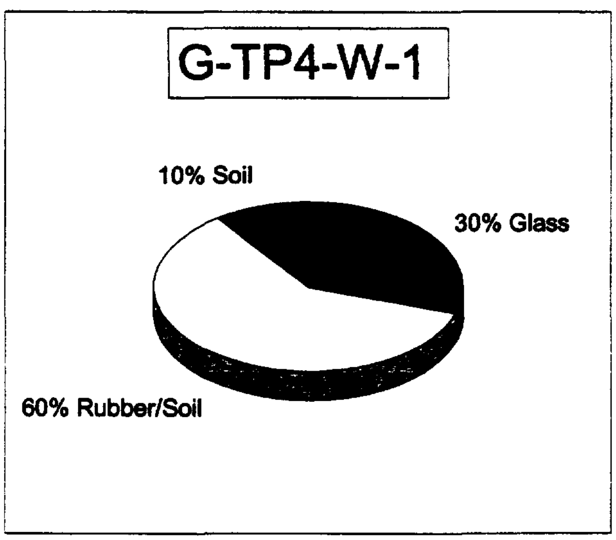


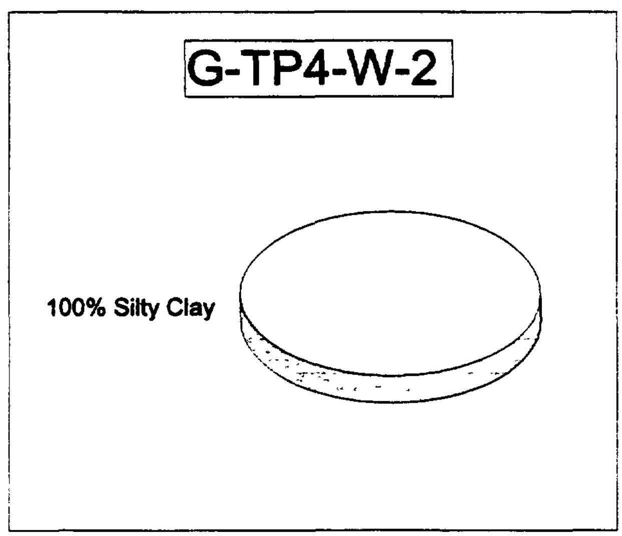
GeoSyntec Consultants

FIGURE 3
SAMPLE COMPOSITION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE



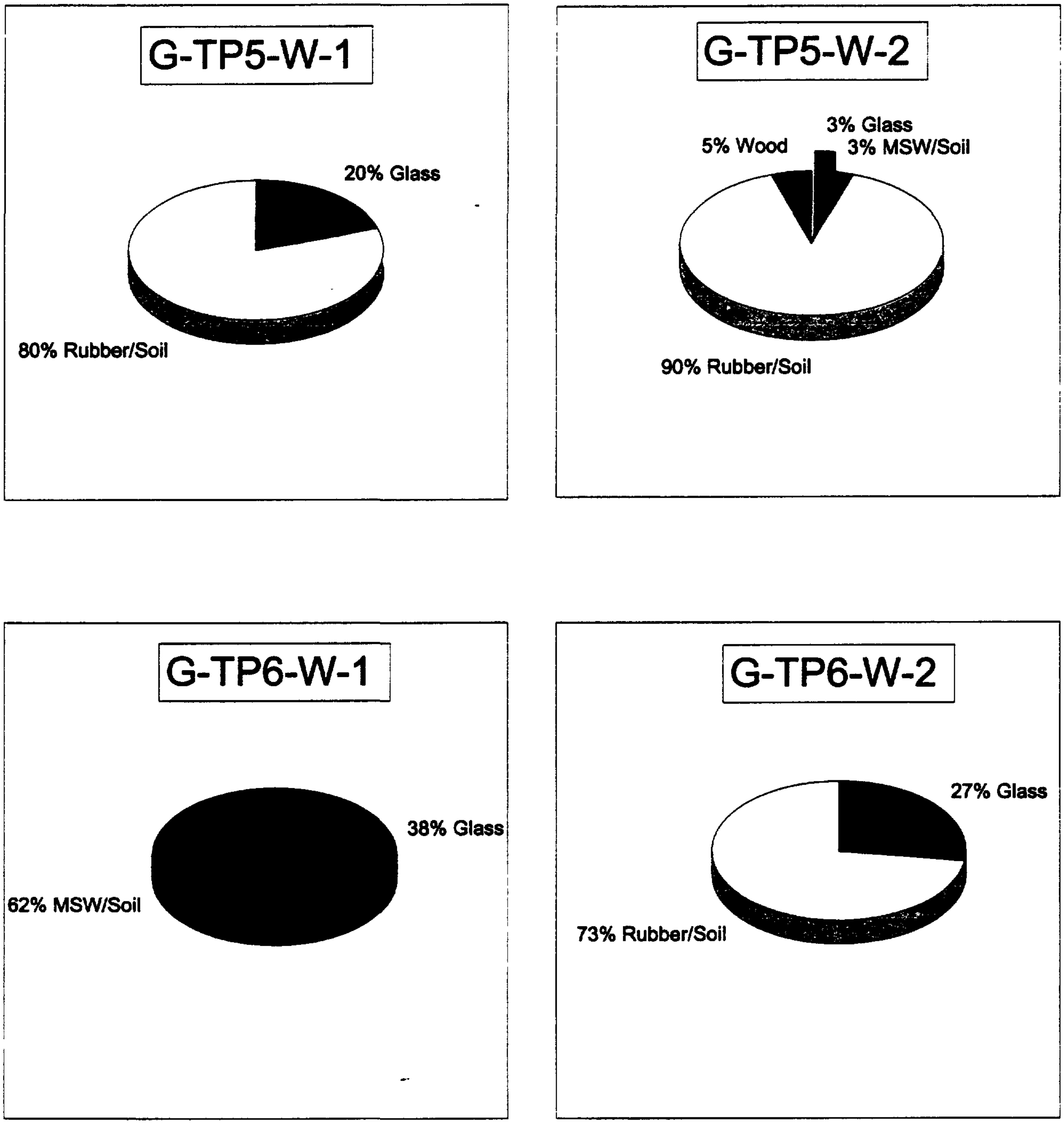






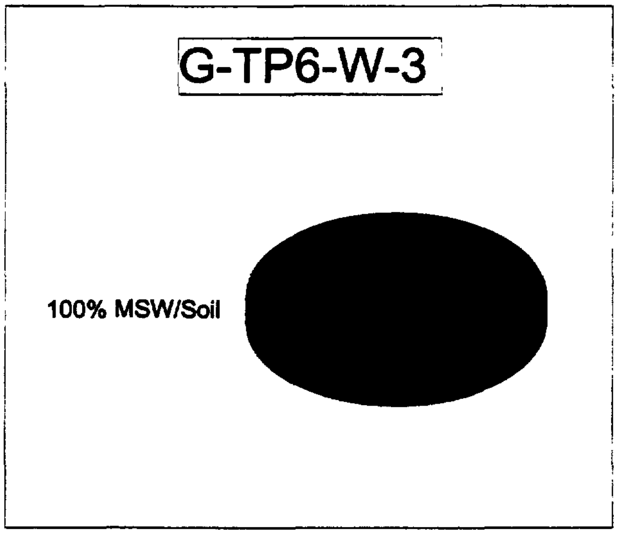
GEOSYNTEC CONSULTANTS

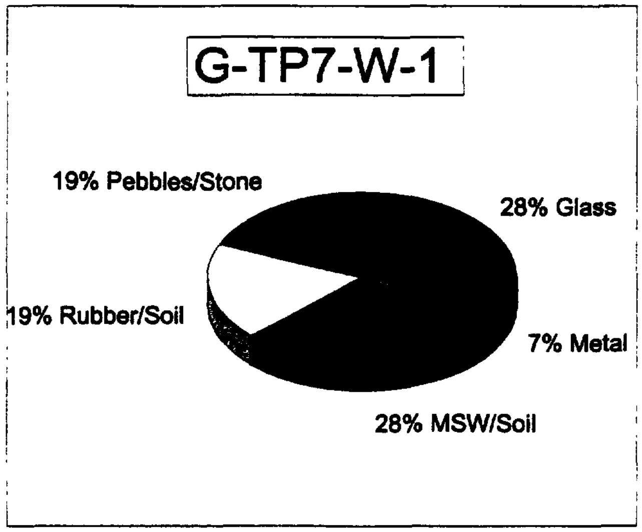
FIGURE 4
SAMPLE COMPOSITION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

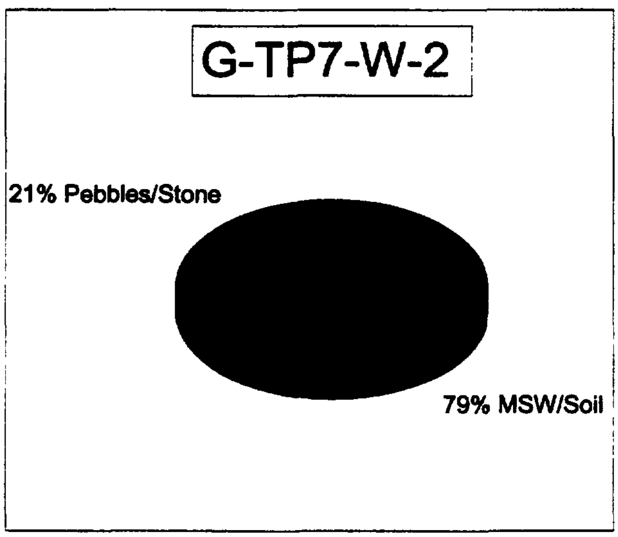


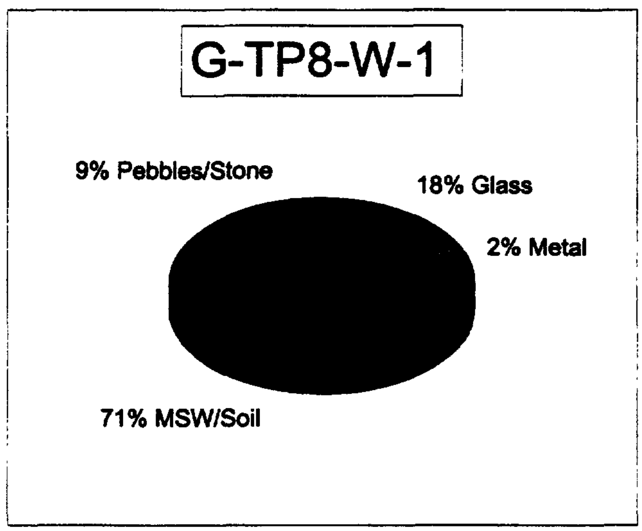
GeoSyntec Consultants

FIGURE 5
SAMPLE COMPOSITION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE



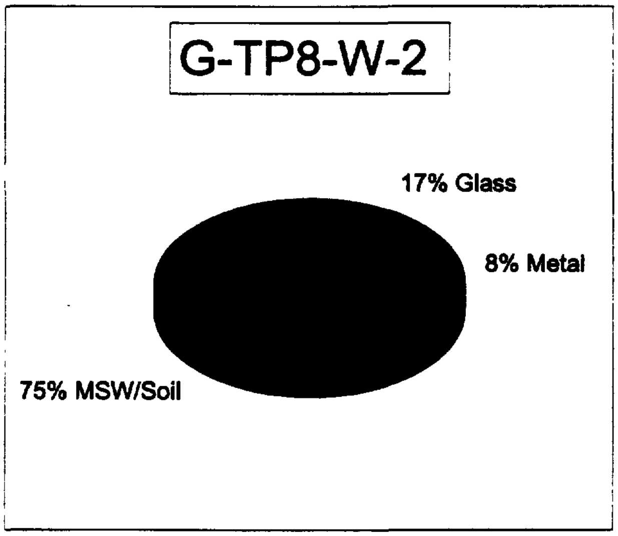


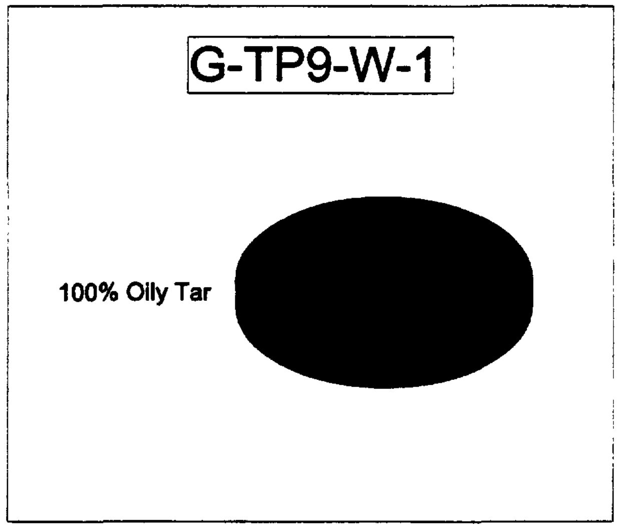


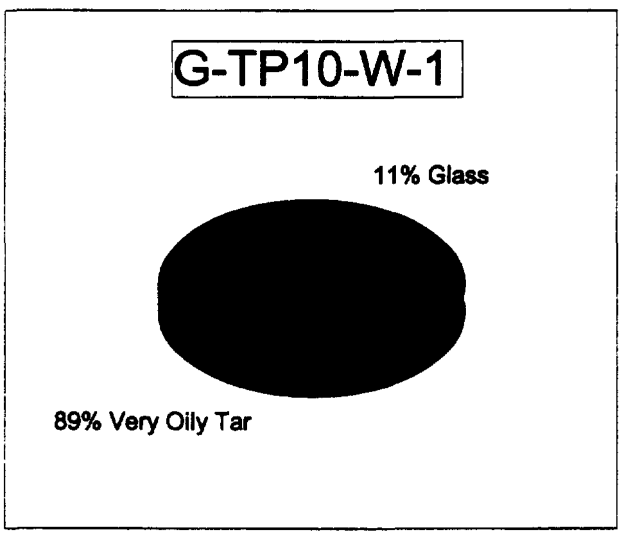


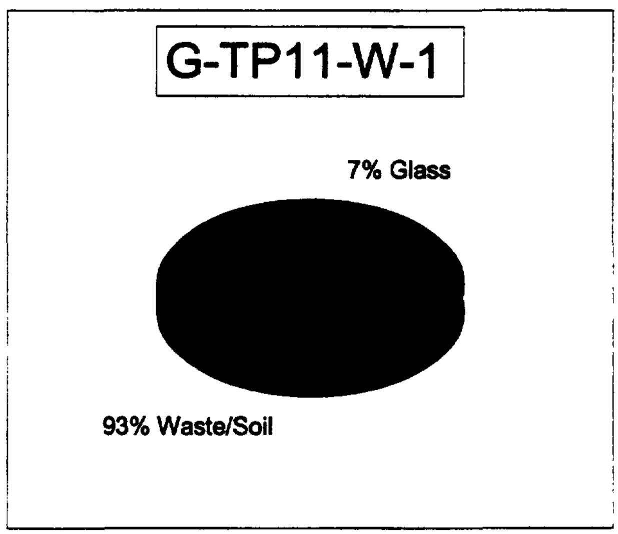
GeoSyntec Consultants

FIGURE 6
SAMPLE COMPOSITION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE



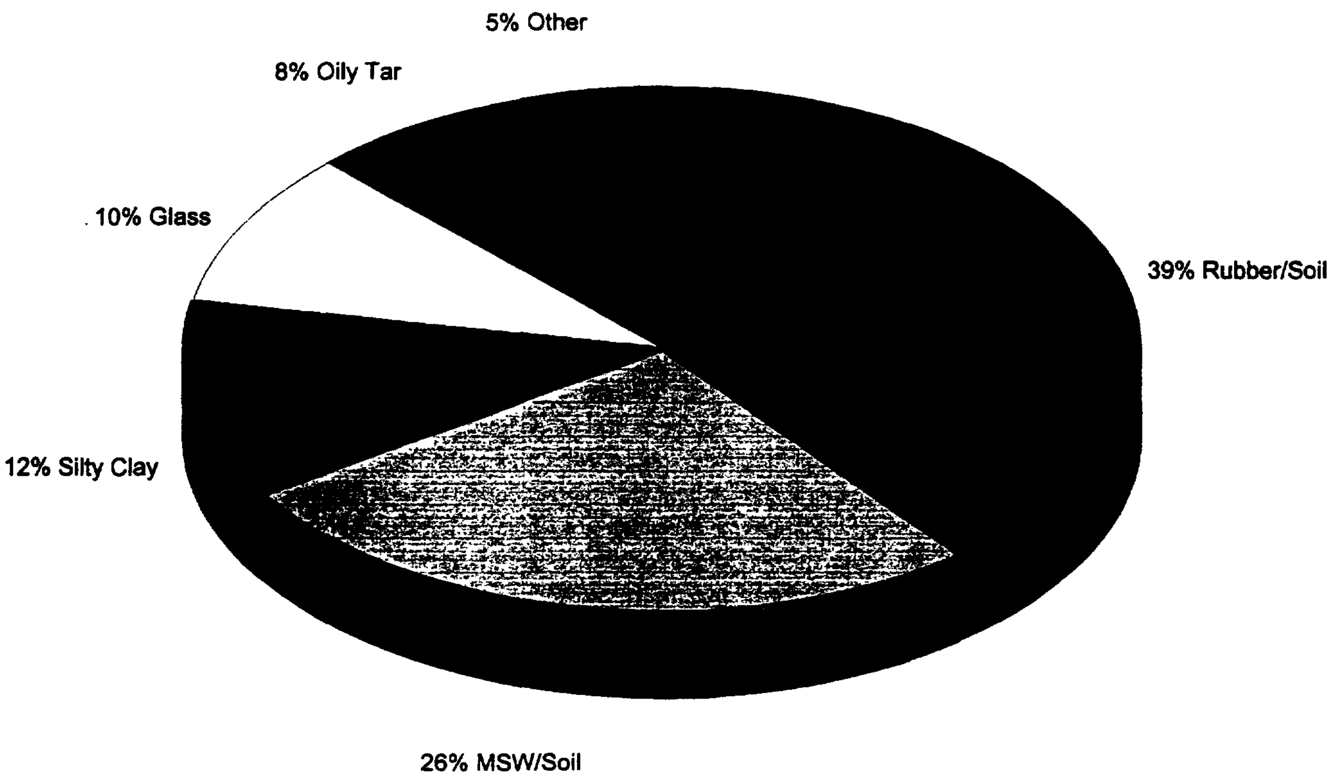




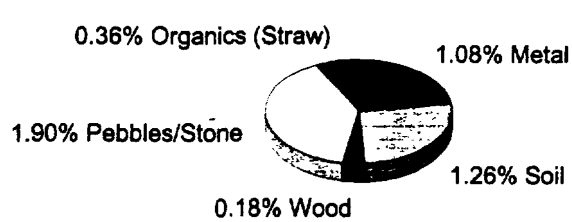


GeoSyntec Consultants

FIGURE 7
TOTAL WASTE COMPOSITION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

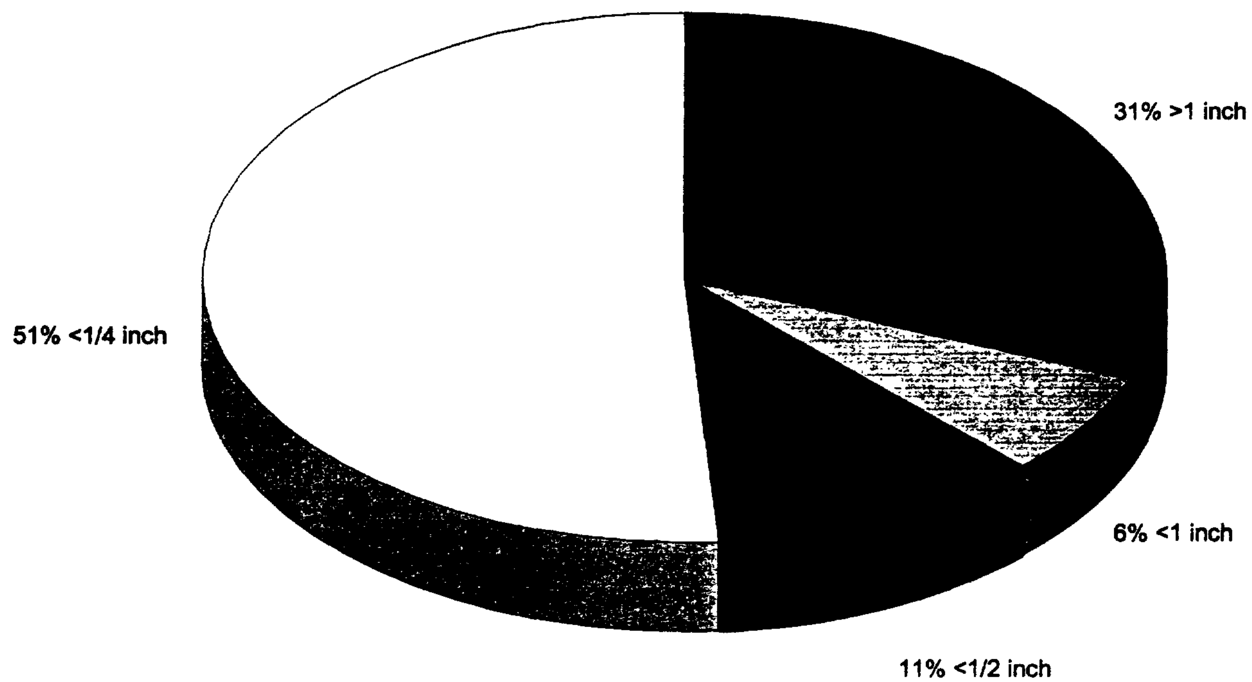


COMPOSITION OF "OTHER"



GeoSyntec Consultants

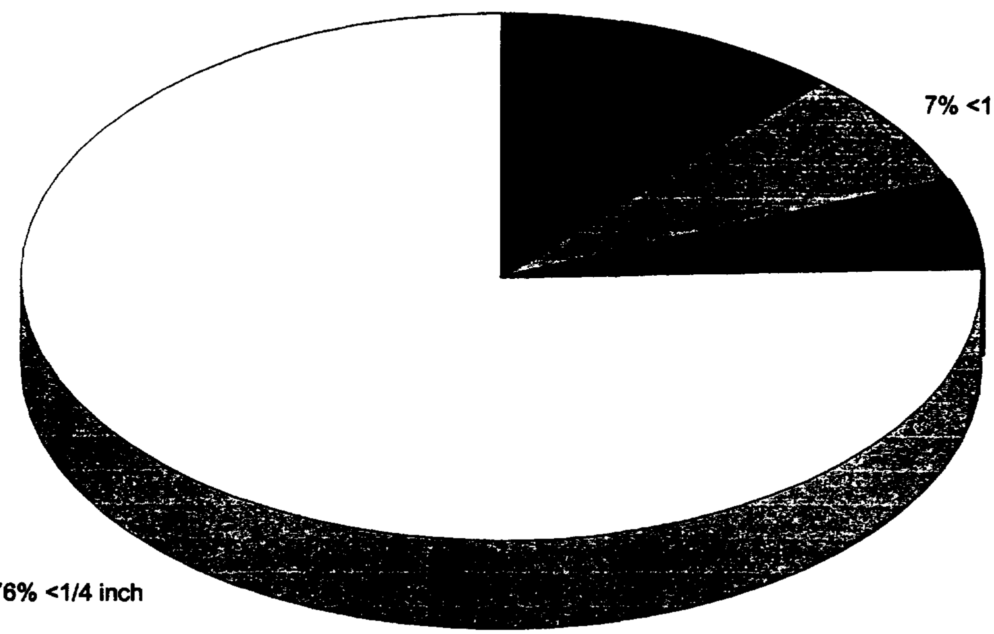
FIGURE 8
RUBBER CRUMB/SOIL GRADATION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE



Notes:
1. Rubber/Soil was observed in 9 of the 20 test pit samples.

GeoSyntec Consultants

FIGURE 9
MUNICIPAL SOLID WASTE/SOIL GRADATION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE

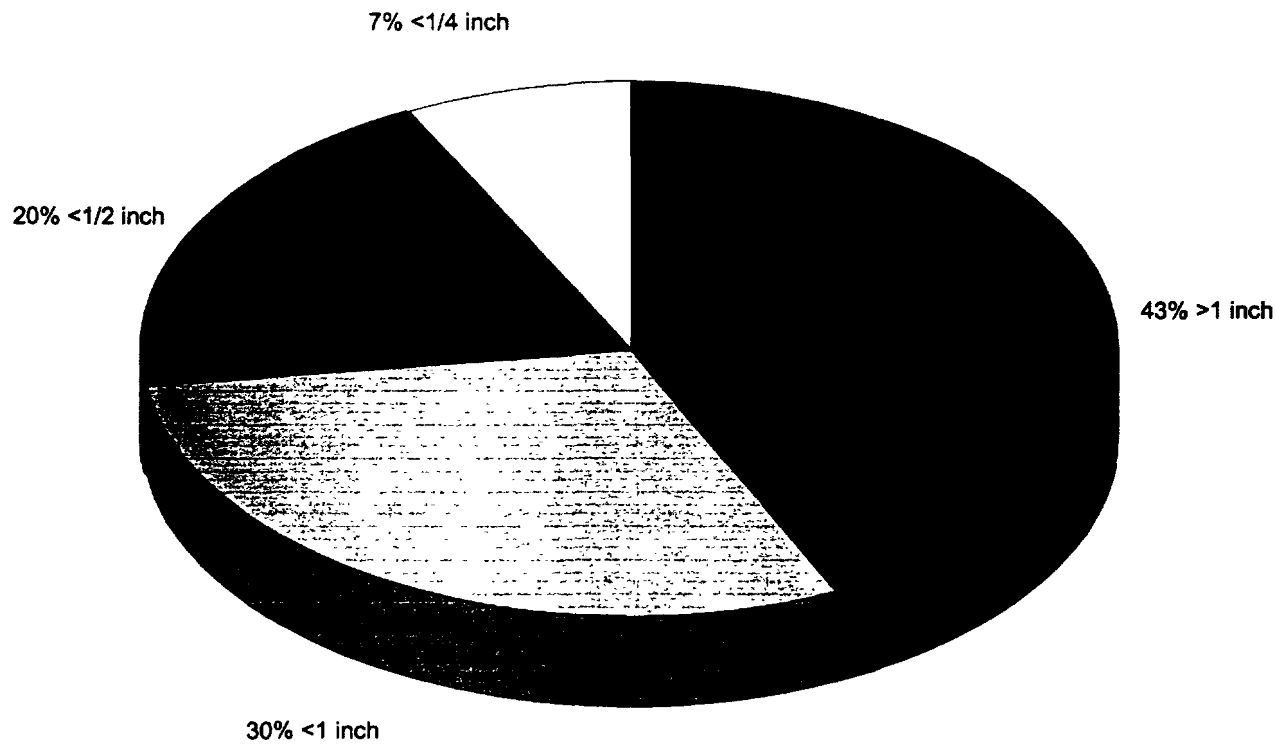


Notes:

1. Municipal Soilid Waste/Soil was observed in 9 of the 20 test pit samples.

GeoSyntec Consultants

FIGURE 10
GLASS GRADATION BY WEIGHT
NORTH DIKE INVESTIGATION
BAILEY SUPERFUND SITE



Notes:

1. Glass was observed in 11 of the 20 test pit samples.

GeoSyntec Consultants

APPENDIX A

TEST PIT OBSERVATIONS AND PHOTOGRAPHS

G-TP1

Date:	22 August 1995
Overburden Thickness (feet):	0.5 to 2.5
Depth to Bottom of Waste (feet):	7.5 to 8.5
Depth to Ground Water (feet):	3.7
Description of Soil Beneath Waste:	Gray silty CLAY with black stains and fine roots
Bottom of Test Pit (feet):	10.0
Samples (Depth (feet)):	G-TP1-W-1 (5.0) G-TP1-W-2 (7.5)

Test Pit Description:

The upper portion of waste (to a depth of approximately 5.0 feet) was light to dark brown in color and primarily a mixture of municipal solid waste and soil. This mixture included metal (5 to 10 percent), glass (5 to 10 percent), large roots and lumber (5 to 10 percent), and soil and decomposed waste (60 to 70 percent).

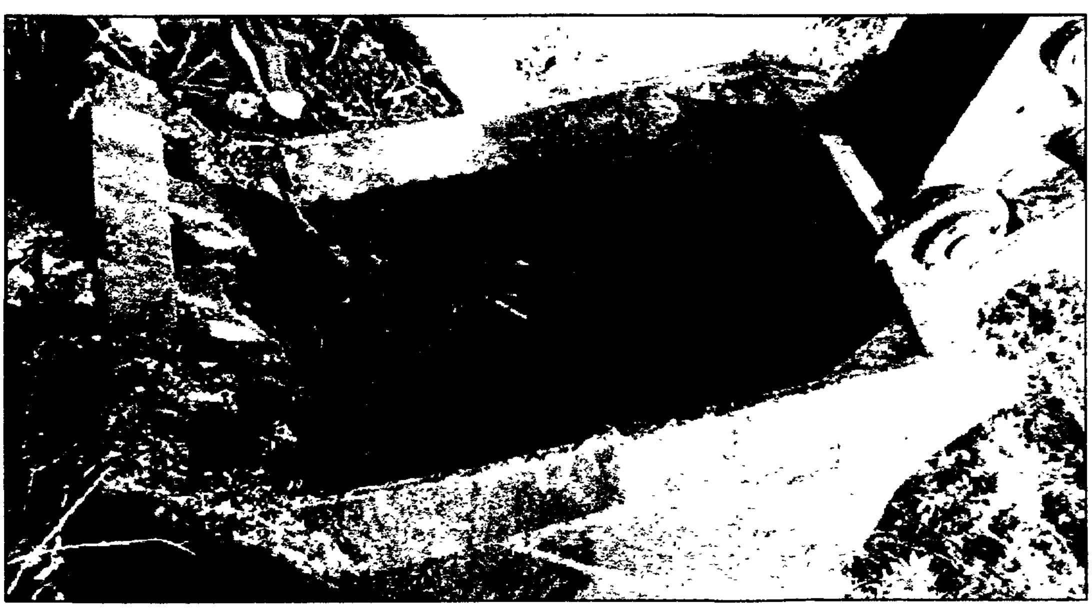
From an approximate depth of 5.0 feet to the bottom of the waste (7.5 to 8.5 feet), the waste was black in color and had an oily sheen. The waste was a mixture of metal (5 to 10 percent); glass (5 to 10 percent); rubbery waste (5 to 10 percent); and decomposed waste, rubber crumb and soil (60 to 70 percent).

Sample Description (G-TP1-W1):

Black oily MUNICIPAL SOLID WASTE AND SOIL MIXTURE with glass and some ferrous metal. The sample had a high liquid content (oily water). Sample headspace reading was 0-20 ppm total volatile organic compounds (VOCs).

Sample Description (G-TP1-W2):

Black silty CLAY with heavy oil/tar contamination. Sample also contained some organic material (straw and fine roots). Sample headspace reading was 0-20 ppm total VOCs.



G-TP2

Date:	22 August 1995
Overburden Thickness (feet):	2.0 to 3.0
Depth to Bottom of Waste (feet):	10.5 to 11.0
Depth to Ground Water (feet):	12.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	12.0
Samples (Depth (feet)):	G-TP2-W-1 (5.5) G-TP2-W-2 (10.0)

Test Pit Description:

The waste was dark brown to black in color and was primarily comprised of soil, rubber crumb, and pieces of rubbery waste. The rubbery waste had a very elastic consistency (similar to soft rubber) that could be pulled like taffy. Relatively small amounts (less than 5 percent) of glass and metal were observed in the waste mixture. A light brown soil/waste layer was encountered in the lower portion of the test pit.

Sample Description (G-TP2-W1):

Black oily RUBBER CRUMB AND SOIL MIXTURE. Sample headspace reading was not taken.

Sample Description (G-TP2-W2):

Black oily RUBBER CRUMB AND SOIL MIXTURE. Sample headspace reading was not taken.

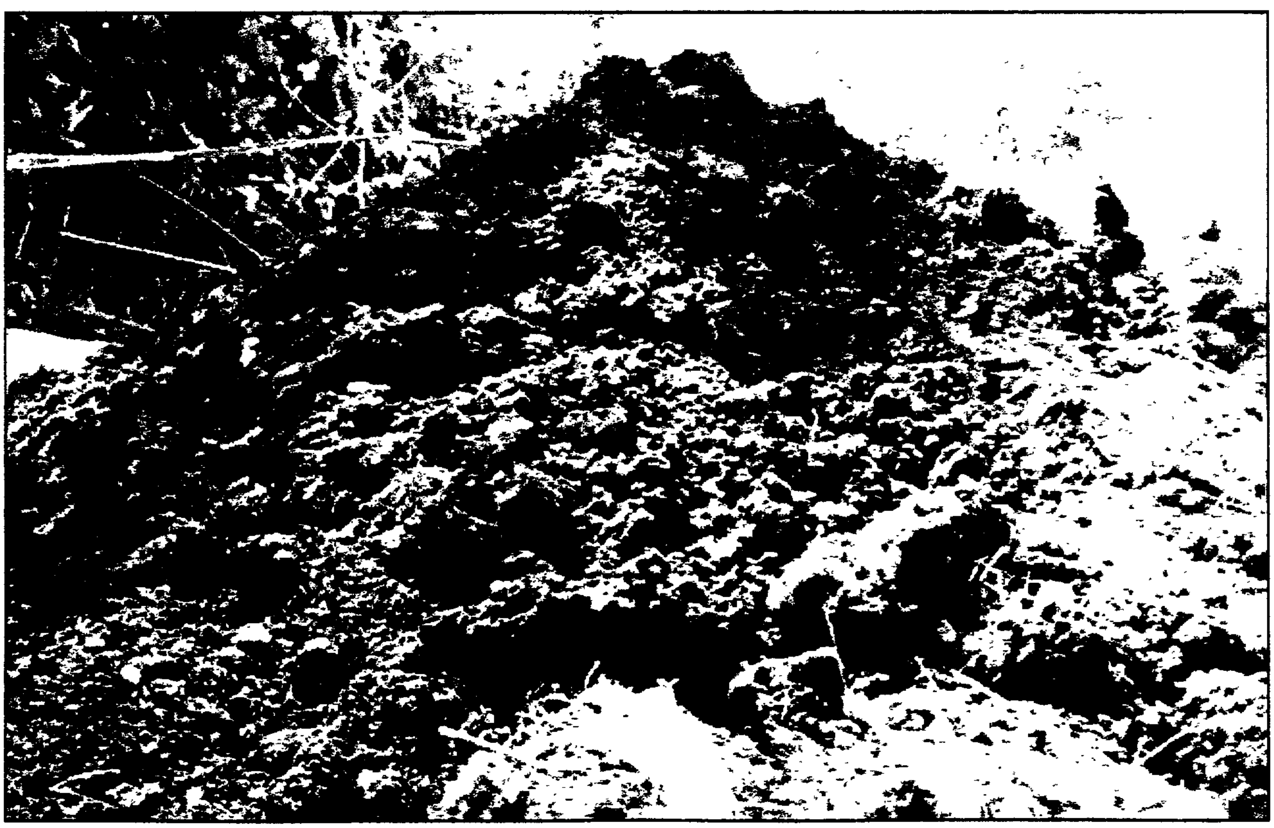
G-TP3

Date:	22 August 1995
Overburden Thickness (feet):	1.0
Depth to Bottom of Waste (feet):	8.0
Depth to Ground Water (feet):	Not encountered
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	10.0
Samples (Depth (feet)):	G-TP3-W-1 (5.0) G-TP3-W-2 (7.0)

Test Pit Description:
The waste was dark brown to black in color and was comprised of soil and rubber crumb.

Sample Description (G-TP3-W1):
Black oily RUBBER CRUMB AND SOIL MIXTURE. Sample headspace reading was 80 ppm total VOCs.

Sample Description (G-TP3-W2):
Black oily RUBBER CRUMB AND SOIL MIXTURE. Sample headspace reading was 20 ppm total VOCs.



G-TP4

Date:	22 August 1995
Overburden Thickness (feet):	0.5 to 1.0
Depth to Bottom of Waste (feet):	5.0
Depth to Ground Water (feet):	4.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	7.5
Samples (Depth (feet)):	G-TP4-W-1 (4.0) G-TP4-W-2 (5.0)

Test Pit Description:

The waste was black in color and had an oily sheen. The waste was a mixture of metal (5 to 10 percent); paper (5 to 10 percent); glass (5 to 10 percent); lumber and large roots (5 to 10 percent); decomposed waste, rubber crumb and soil (60 to 80 percent). The waste material also contained two automobile tires.

Sample Description (G-TP4-W1):

Black oily RUBBER CRUMB AND SOIL MIXTURE with glass. Sample also contained some clay and a small quantity of organic material (straw and fine roots). Sample headspace reading was 10-15 ppm total VOCs.

Sample Description (G-TP4-W2):

Gray silty CLAY with some black oily (free product) contamination. Sample headspace reading was 0 ppm total VOCs.

G-TP5

Date:	23 August 1995
Overburden Thickness (feet):	0.0 to 0.5
Depth to Bottom of Waste (feet):	10.0 to 11.0
Depth to Ground Water (feet):	3.0 to 4.0
Description of Soil Beneath Waste:	Light brown sandy SILT with clay and black stains
Bottom of Test Pit (feet):	12.0
Samples (Depth (feet)):	G-TP5-W-1 (5.0) G-TP5-W-2 (10.0 to 11.0) G-TP5-S-1 (11.0 to 12.0)
Waste Temperature:	G-TP5-W-1: 78 degrees Fahrenheit

Test Pit Description:

The upper portion of waste (to a depth of approximately 3.0 feet) was light to dark brown in color and primarily a mixture of municipal solid waste and soil. This mixture included metal (5 to 10 percent), glass (5 to 10 percent), and soil and decomposed waste (80 to 90 percent). The upper portion of the waste also included several automobile tires and a 55-gallon drum.

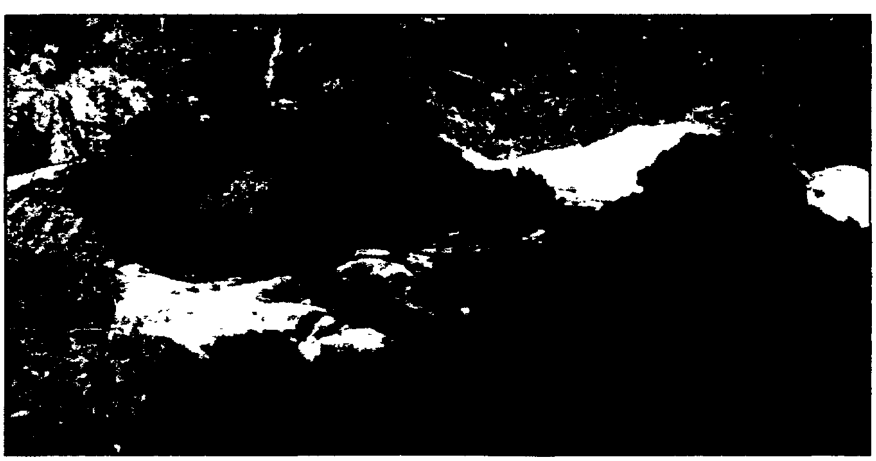
From an approximate depth of 3.0 feet to the bottom of the waste (10.0 to 11.0 feet), the waste was black in color and had an oily sheen. The waste was a mixture of metal (5 to 10 percent); glass (5 to 10 percent); paper (less than 5 percent); wood waste (less than 5 percent); rubbery waste (5 to 10 percent); and decomposed waste, rubber crumb and soil (60 to 70 percent).

Sample Description (G-TP5-W1):

Black oily RUBBER CRUMB AND SOIL MIXTURE. Sample also contained some glass and some small pieces of municipal waste (not discernible from rubber crumb). Sample headspace reading was 5-10 ppm total VOCs.

Sample Description (G-TP5-W2):

This sample appeared to have been taken at the soil/waste interface, as the sample was readily split into soil and waste fractions. The soil was gray silty CLAY. Only the waste fraction was hand-sorted. The waste was a black very tarry RUBBER CRUMB AND SOIL MIXTURE with fragments of wood and glass. Sample headspace reading was 50 ppm total VOCs.



G-TP6

Date:	23 August 1995
Overburden Thickness (feet):	0.5 to 1.5
Depth to Bottom of Waste (feet):	12.0
Depth to Ground Water (feet):	5.0 to 6.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	13.0
Samples (Depth (feet)):	G-TP6-W-1 (5.0) G-TP6-W-2 (10.0) G-TP6-W-3 (11.5 to 12.0)
Waste Temperature:	G-TP6-W-2: 78 degrees Fahrenheit

Test Pit Description:

The waste was black in color and had an oily sheen. The waste was a mixture of metal (10 to 20 percent); glass (10 to 20 percent); wood waste (5 to 10 percent); and decomposed waste, rubber crumb and soil (60 to 70 percent). The metal portion of the waste was comprised of relatively large pieces (2 square feet and greater) and metal pipe (1 to 2 inches in diameter). The wood portion of the waste was observed in the lower portions of the test pit.

Sample Description (G-TP6-W1):

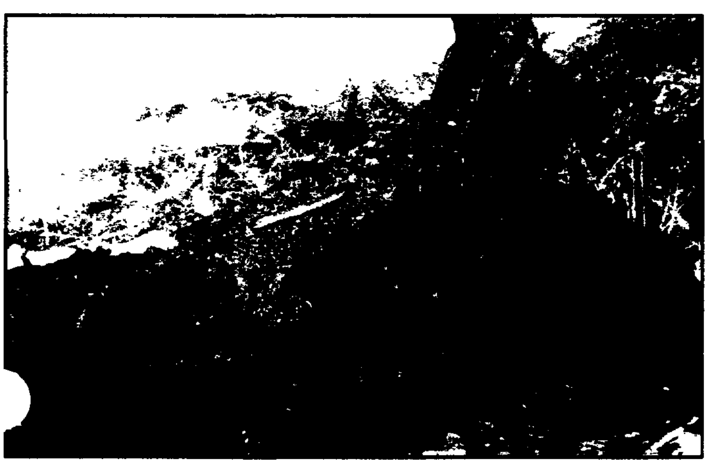
Black very oily MUNICIPAL SOLID WASTE, RUBBER CRUMB, AND SOIL MIXTURE (could not be separated) with glass. Sample also contained some oily "free product". Sample headspace reading was 60 ppm total VOCs.

Sample Description (G-TP6-W2):

Black oily RUBBER CRUMB AND SOIL MIXTURE with some glass. Sample headspace reading was 40-50 ppm total VOCs.

Sample Description (G-TP6-W3):

Black very oily MUNICIPAL SOLID WASTE AND SOIL MIXTURE with some debris (metal strap, wood, wire, and a circuit breaker). Sample also contained some oily "free product". Sample had a very sticky fluid-like consistency. Sample headspace reading was not taken.



G-TP7

Date:	23 August 1995
Overburden Thickness (feet):	1.0 to 1.5
Depth to Bottom of Waste (feet):	8.0 to 9.0
Depth to Ground Water (feet):	4.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains and fine roots
Bottom of Test Pit (feet):	11.0
Samples (Depth (feet)):	G-TP7-W-1 (5.0) G-TP7-W-2 (8.0) G-TP7-S-1 (9.0)

Test Pit Description:

The waste was black in color and had an oily sheen. The waste was a mixture of metal (20 to 30 percent); glass (5 to 10 percent); wood waste (5 to 10 percent); and decomposed waste, rubber crumb and soil (50 to 60 percent). The metal portion of the waste was comprised of a water heater, 55-gallon drum, relatively large metal pieces (2 square feet and greater), pipe (1 to 2 inches in diameter), and wire. The wood portion of the waste contained pieces of plywood and other lumber.

Sample Description (G-TP7-W1):

Black very oily MUNICIPAL SOLID WASTE AND RUBBER CRUMB MIXTURE with some glass, metal, and pebbles. Sample headspace reading was 15 ppm total VOCs.

Sample Description (G-TP7-W2):

Black very oily MUNICIPAL SOLID WASTE with gray silty clay clods and oily pea gravel. Sample headspace reading was 10 ppm total VOCs.

G-TP8

Date:	23 August 1995
Overburden Thickness (feet):	0.5 to 1.0
Depth to Bottom of Waste (feet).	6.0 to 7.0
Depth to Ground Water (feet):	2.5 to 3.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	9.0
Samples (Depth (feet)):	G-TP8-W-1 (5.0) G-TP8-W-2 (6.0 to 7.0) G-TP8-S-1 (7.0 to 8.0)
Waste Temperature:	G-TP8-W-1: 80 degrees Fahrenheit

Test Pit Description:

The waste was black in color and had an oily sheen. The waste was a mixture of metal (15 to 20 percent); glass (5 to 10 percent); wood waste (5 to 10 percent); and decomposed waste, rubber crumb and soil (60 to 80 percent). The metal portion of the waste was comprised of relatively large pieces (2 square feet and greater), pipe (1 to 2 inches in diameter), and wire.

Sample Description (G-TP8-W1):

Black oily MUNICIPAL SOLID WASTE with some glass, metal (non ferrous), and pebbles Sample headspace reading was not taken.

Sample Description (G-TP8-W2):

Black oily to very oily MUNICIPAL SOLID WASTE with some glass and metal (non ferrous). Sample headspace reading was not taken.

G-TP9

Date:	23 August 1995
Overburden Thickness (feet):	0.0
Depth to Bottom of Waste (feet):	Not encountered
Depth to Ground Water (feet):	0.5 to 1.0
Description of Soil Beneath Waste:	Not encountered
Bottom of Test Pit (feet):	4.5
Samples (Depth (feet)):	G-TP9-W-1 (0.0 to 4.0)

Test Pit Description:

The waste was a dark gray to black sludge with an oily sheen. The waste had very little strength; it was unable to support its own weight when placed in the stockpile and the walls of the test pit would not stay open. The waste was primarily comprised of rubbery waste, rubber crumb, decomposed waste, soil, and an oily liquid (ground water mixed with waste). It also contained roots, metal pipe, glass bottles, and pieces of plywood.

Sample Description (G-TP9-W1):

Black and dark gray very viscous oily TAR-LIKE MATERIAL. The sample also contained some large animal bones. The sample was not sieved due to its tar-like consistency. The sample had no apparent odor, but the sample headspace reading was 50-60 ppm total VOCs.

G-TP10

Date:	23 August 1995
Overburden Thickness (feet):	1.0 to 1 5
Depth to Bottom of Waste (feet):	6.0
Depth to Ground Water (feet):	1.5 to 2.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	7.0
Samples (Depth (feet)):	G-TP10-W-1 (4.0 to 5.0)

Test Pit Description:

The waste was black in color and had an oily sheen. The waste was a mixture of metal (5 to 10 percent); unbroken glass bottles (30 percent); glass (10 percent); and metal pipe (less than 5 percent); rubbery waste (10 to 20 percent); and decomposed waste, soil, and rubber crumb (40 to 50 percent). The rubbery waste was observed at a depth of 2 to 6 feet.

Sample Description (G-TP10-W1):

Black very oily TAR-LIKE MATERIAL AND MUNICIPAL SOLID WASTE MIXTURE with some rags, roots (organic), and glass. The sample also contained a small quantity of tan colored clay clods. The sample was not sieved due to its tar-like consistency. Sample headspace reading was 20 ppm total VOCs.

G-TP11

Date:	24 August 1995
Overburden Thickness (feet):	1.0
Depth to Bottom of Waste (feet):	5.0
Depth to Ground Water (feet):	4.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	6.0
Samples (Depth (feet)):	G-TP11-W-1 (4.0 to 5.0) G-TP11-S-1 (5.0 to 6.0)

Test Pit Description:

The waste was black in color and had an oily sheen. The waste was a mixture of metal (40 to 60 percent); glass (5 to 10 percent); wood (5 to 10 percent); and decomposed waste, soil, and rubber crumb (20 to 30 percent). The metal portion of the waste was comprised of pipe, wire, and metal that ranged in size from small pieces of rusted metal less than approximately 1 square inch to metal pieces greater than 2 square feet.

Sample Description (G-TP11-W1):

Black very oily MUNICIPAL SOLID WASTE AND SOIL MIXTURE with glass. Sample headspace reading was 0 ppm.

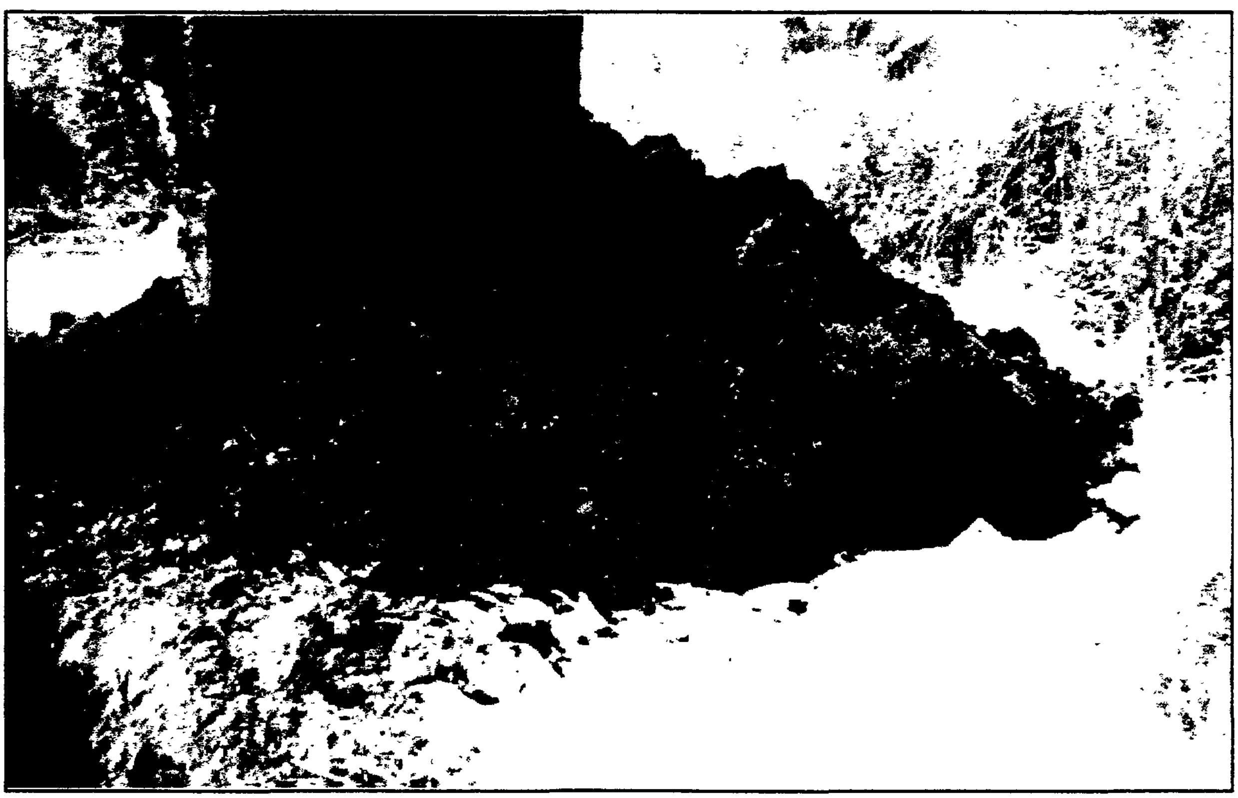
G-TP12

Date:	24 August 1995
Overburden Thickness (feet):	0.5
Depth to Bottom of Waste (feet):	6.5
Depth to Ground Water (feet):	4.5 to 5.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	8.0
Samples (Depth (feet)):	G-TP12-W-1 (5.5 to 6.0) G-TP12-W-2 (6.5) G-TP12-S-1 (7.0 to 8.0)

Test Pit Description:

The upper portion of waste (to a depth of approximately 3.0 to 4.0 feet) was dark brown in color and primarily a mixture of municipal solid waste and soil. This mixture included metal (5 to 10 percent), glass (5 to 10 percent), roots and lumber (less than 5 percent), and soil and decomposed waste (80 to 90 percent).

From an approximate depth of 3.0 to 4.0 feet to the bottom of the waste (6.5 feet), the waste was black in color. An oily sheen was observed on the waste at a depth of approximately 6.0 to 6.5 feet. The waste was a mixture of metal (5 to 10 percent); glass (5 to 10 percent); and decomposed waste, rubber crumb and soil (80 to 90 percent).



G-TP13

Date:	24 August 1995
Overburden Thickness (feet):	1.0 to 1.5
Depth to Bottom of Waste (feet):	8.5
Depth to Ground Water (feet):	8.0
Description of Soil Beneath Waste:	Gray silty CLAY with black stains
Bottom of Test Pit (feet):	9.5
Samples (Depth (feet)):	G-TP13-W-1 (5.0 to 6.0) G-TP13-S-1 (8.5 to 9.0)

Test Pit Description:

The upper portion of waste (to a depth of approximately 2.0) was dark brown in color and primarily a mixture of municipal solid waste (metal, glass, wood) and soil. The waste material below approximately 2 feet contained a dark brown to black mixture of decomposed waste, rubber crumb, rubbery waste, and soil. A piece of concrete approximately 3 feet in diameter and 3 to 4 inches thick was observed at a depth of approximately 3.0 feet.

NOMENCLATURE

Major sample components:	upper case letters used to describe predominant component (e.g., "MUNICIPAL SOLID WASTE"). When two or more predominant components could not be separated by hand or by sieving, the word "MIXTURE" is used (e.g. MUNICIPAL SOLID WASTE AND SOIL MIXTURE).
Secondary sample component:	adjective used if visually significant (e.g. "silty", "oily").
Third sample component:	the word "with" is used where component is less than secondary component, but still significant.
Fourth sample component:	the word "some" is used where component is less than third component, but is still significant.

DEFINITIONS

MUNICIPAL SOLID WASTE - This description is used for decomposed or partially decomposed material that probably originated as household waste, commercial solid waste, non-hazardous sludge, small quantity generator waste, or industrial solid waste. Typically the material categorized as municipal solid waste was a black detritus with occasional identifiable components (e.g. glass, wire, wood and other debris). It typically had a high moisture or liquid content, and an organic smell. In several cases, the material was classified as MUNICIPAL SOLID WASTE AND SOIL MIXTURE. This description was used when the material appeared to have a soil content (either granular or silty clay), but the soil fraction could not be physically separated by hand picking or by sieving. It is likely that the soil was originally added to the waste as a daily or intermediate cover. As the waste decomposed and was tracked over by heavy equipment, it likely became mixed with the waste.

RUBBER CRUMB - This description is used for small pieces (generally less than 1 inch in diameter) of black material that generally exhibited a high elasticity (i.e. when stretched or compressed would tend to rebound). The material appeared to have a high carbon-black content, and was observed in several states ranging from a tough fairly stiff rubber, to a semi-elastic material that was very tarry and sticky (almost caramel consistency). This material was present as a RUBBER CRUMB AND SOIL MIXTURE. It could be separated from the overall waste matrix as a mixture by sieving, but the mixture itself was not readily separated into soil and rubber components by sieving. The composition of the mixture was visually estimated to range from 80:20 (rubber:soil) to 50:50 (rubber:soil). At a few locations (generally near the east end of the North Dike), the material was oily but friable, and appeared to have a higher carbon-black content. The mixture had a strong odor of hydrocarbons (used motor oil), and generally gave a significant reading (i.e. greater than 10 ppm) on VOC monitoring equipment.

Silty CLAY - This description was used for soil that exhibited some plasticity, but also appeared to have a high silt content. Due to the presence of oils, tars and other waste materials, no attempt was made to distinguish between silty CLAY and clayey SILT.

TAR-LIKE MATERIAL - This term was used to describe black oily waste material that was a sticky, elastic, viscous substance that had a consistency of a rubbery sludge (similar to caramel or taffy). The material appeared to have a high organic content. The headspace readings for samples of this material ranged from 20 to 60 ppm total VOCs.

APPENDIX B

LABORATORY TESTING RESULTS

GeoSyntec Consultants

Geomechanics & Environmental Laboratory
5775 Peachtree Dunwoody Road, Suite 10D
Atlanta, Georgia 30342 • USA
Tel. (404) 705-9500 • Fax (404) 705-9300

28 September 1995

Mr. R. Neil Davies, P.E.
GeoSyntec Consultants
1100 Lake Hearn Drive, Suite 200
Atlanta, Georgia 30342

Subject: Final Report - Laboratory Test Results
Supplemental Site Investigation, North Dike Area
Bailey Superfund Site
Bridge City, Texas

Dear Mr. Davies:

GeoSyntec Consultants (GeoSyntec) Geomechanics and Environmental Laboratory in Atlanta, Georgia, is pleased to present the attached final test results (Tables 1 and 2 and Figure 1) for the above referenced project. A blank shown on any of the tables or the figure indicates that the test was not performed, the parameter is not applicable, or that the test resulted in insufficient data to report the designated parameter. Attachment A presents the general information pertinent to the testing program, and the policy of GeoSyntec regarding the limitations and use of the test results.

The Geomechanics and Environmental Laboratory appreciates the opportunity to provide testing services for this project. Should you have any questions regarding the attached test results or if you require additional information, please do not hesitate to contact either of the undersigned.

Sincerely,

Brian D. Jacobson, E.I.T.
Assistant Program Manager
Environmental Testing

Nader S. Rad, Ph.D., P.E.
Laboratory Director

Attachment

GE3913.05/GEL95281

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS
WASTE

BAILEY SITE SETTLORS COMMITTEE (BSSC)
SUPPLEMENTAL SITE INVESTIGATION, NORTH DIKE AREA

Site Sample ID	Lab Sample No.	Moisture Content[1] ASTM D 2216 (%)	Percent Passing No. 4 Sieve (%)	Loss on Ignition[2][3][4] ASTM D 2947 (%)
G-TP1-W-1	E95I20	36.2	79.7	4.0
G-TP2-W-2	E95I21	38.4	100.0	46.8
G-TP3-W-1	E95I22	66.1	100.0	51.2
G-TP4-W-1	E95I23	41.5	84.9	13.5
G-TP5-W-2	E95I24	33.7	100.0	21.2
G-TP6-W-2	E95I25	56.9	87.0	30.1
G-TP7-W-1	E95I26	67 0	63.6	22.7
G-TP8-W-1	E95I27	41.8	85.6	14.3
G-TP11-W-1	E95I28	46.1	85.1	11.6

Notes:

1. Values were determined using a representative specimen of the bulk sample.
2. Testing was performed on the portion of the oven-dried material which passed through a standard No. 4 sieve.
3. Oven temperature was 824°F (440°C).
4. The Loss on Ignition (LOI) test is a measure of the weight of all organic material in the specimen. The Total Organic Carbon (TOC) test is a measure of the weight of only the organic carbon in the specimen.

TABLE 2

SUMMARY OF LABORATORY TEST RESULTS
SOIL

BAILEY SITE SETTLORS COMMITTEE (BSSC)
SUPPLEMENTAL SITE INVESTIGATION, NORTH DIKE AREA

Client Sample ID	Lab Sample No.	Sample Depth (ft)	Grain Size: Percent Passing #200 Sieve ASTM D 1140 (%)	Grain Size: ASTM D 422 Sieve Figure No.	Grain Size: ASTM D 422 Hydrom. Figure No.	Atterberg Limits ASTM D 4318: LL (%)	Atterberg Limits ASTM D 4318: PL (%)	Atterberg Limits ASTM D 4318: PI (-)	Soil Classification ASTM D 2487	Compaction ASTM D 698: Max Dry Unit Weight (pcf)	Compaction ASTM D 698: Optimum Moisture Content (%)	Compaction ASTM D 698: Figure No.	Hydraulic Conductivity ASTM D 5084: Test Specimen Initial Conditions Dry Unit Weight (pcf)	Hydraulic Conductivity ASTM D 5084: Test Specimen Initial Conditions Moisture Content (%)	Hydraulic Conductivity ASTM D 5084: Test Specimen Initial Conditions Effective Stress (psi)	Hydraulic Conductivity ASTM D 5084: Hydraulic[1] Conductivity (cm/s)
G-TP5-S-1	E95132		64.0	1		42	32	10	ML - Gravelly Silt with Sand							
G-TP6-S-1	E95130		99.6			67	24	43	CH - Fat Clay				53.3	76.8	5	1.1E-7
G-TP8-S-1	E95131		96.5			35	21	14	CL - Lean Clay				84 1	30 8	5	1.6E-7
G-TP11-S-1	E95133		97.4			46	17	29	CL - Lean Clay							
G-TP12-S-1	E95134		96.8			52	20	32	CH - Fat Clay							
G-TP13-S-1	E95129		96 2			55	26	29	CH - Fat Clay				80.6	36.9	5	3 3E-7

Note:

1. The hydraulic conductivity values were determined using falling head hydralic gradients ranging from 12 to 3.

GEO SYNTEC CONSULTANTS
Geomechanics and Environmental Laboratory
Atlanta, Georgia

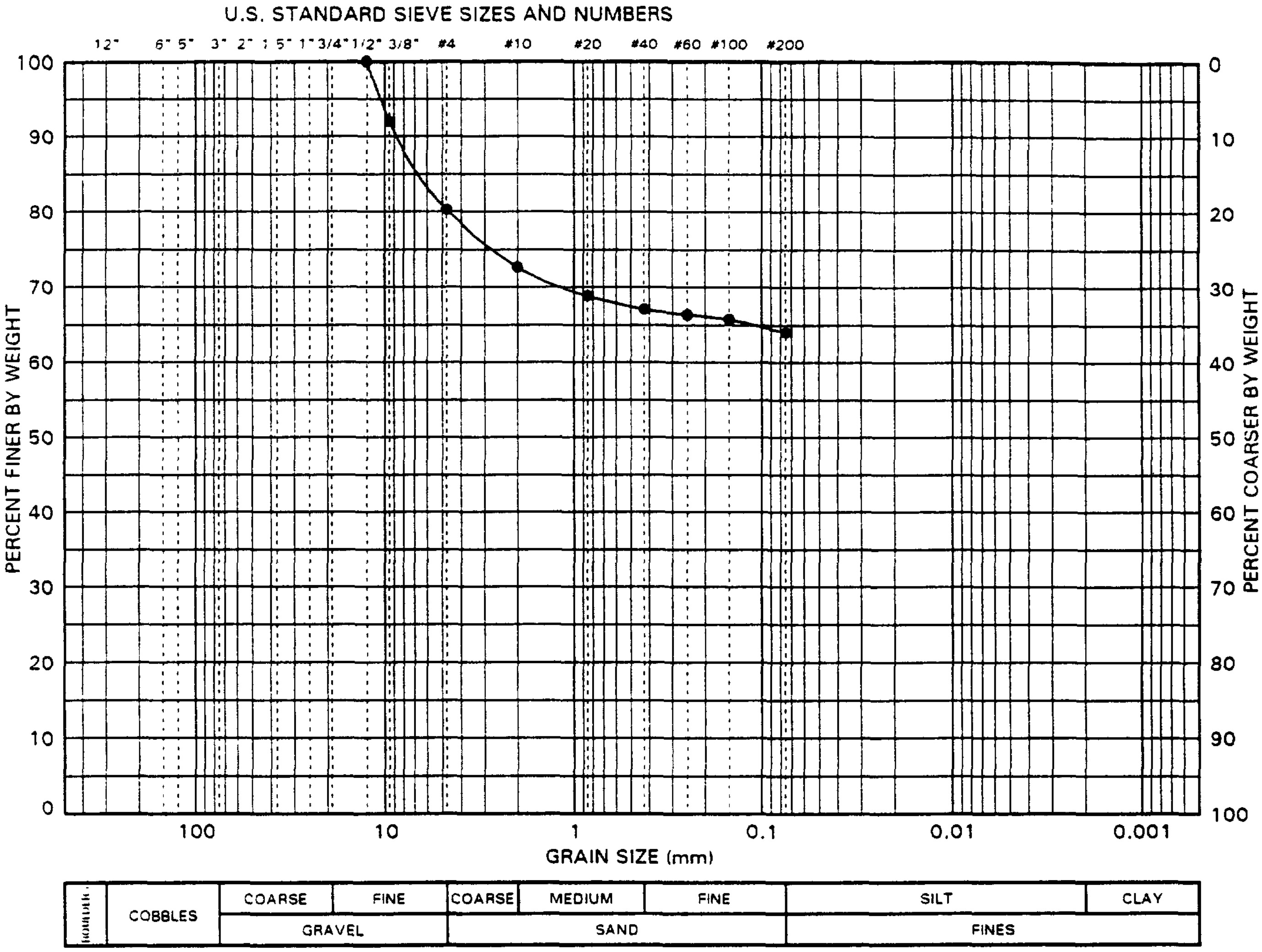
FIGURE 1

PROJECT: BAILEY SITE - SSI - NORTH DIKE
PROJECT NO.: GE3913
DOCUMENT NO.: GEL95281

GS FORM: 4PS2 09/27/95

PARTICLE SIZE DISTRIBUTION AND PHYSICAL PROPERTIES

ASTM C 136, D 422, D 2487 D 3042 AND D 4318



SITE SAMPLE ID	G-TP5-S-1	LIQUID LIMIT (%)	42	SOIL FRACTIONS	GRAVEL (%)	19.7
LAB. SAMPLE NO.	E95132	PLASTIC LIMIT (%)	32		SAND (%)	16.3
SAMPLE DEPTH (ft)		PLASTICITY INDEX	10		FINES (%)	64.0
SOIL CLASSIFICATION: ML - Gravelly Silt with Sand					SILT (%)	
					CLAY(%)	
					COEFF. UNIFORMITY (Cu)	
					COEFF. CURVATURE (Cc)	

PERCENT PASSING U.S. STANDARD SIEVE SIZES AND NUMBERS														PERCENT FINER THAN HYDROMETER PARTICLE DIAMETER (mm)				
3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200					
PERCENT PASSING SIEVE SIZES (mm)																		
75	50	37.5	25	19	12.5	9.5	4.75	2.00	0.850	0.425	0.250	0.150	0.075	0.050	0.020	0.005	0.002	0.001
100	100	100	100	100	100	92	80	73	69	67	66	66	64					

NOTES:

ATTACHMENT A

Sample Identification, Handling, Storage and Disposal

Laboratory Test Standards

Application of Test Results

SAMPLE IDENTIFICATION, HANDLING, STORAGE AND DISPOSAL

Test materials were sent to GeoSyntec Consultants (GeoSyntec) Geomechanics and Environmental Laboratory in Atlanta, Georgia by the client or its representative(s). Samples delivered to the laboratory were identified by client sample identification (ID) numbers which had been assigned by representative(s) of the client. Upon being received at the laboratory, each sample was assigned a laboratory sample number to facilitate tracking and documentation.

Based on the information provided to GeoSyntec by the client or its representative(s) and, when applicable, procedural guidelines recommended by an industrial hygiene consultant, the following Occupational Safety and Health Administration (OSHA) level of personal protection was adopted for handling and testing of the test materials:

[ ] test materials were not contaminated, no special protection measures were taken;
[X] level D
[ ] level C
[ ] level B

In accordance with the health and safety guidelines of GeoSyntec, contaminated materials are stored in a designated containment area in the laboratory. Non-contaminated materials are stored in a general storage area in the laboratory.

GeoSyntec Geomechanics and Environmental Laboratory will continue storing the test materials for a period of 30 days from the date of this report or a year from the time that the samples were received, which ever is shorter. Thereafter: (i) contaminated materials will be returned to the client or its designated representative(s); and (ii) the materials which are not contaminated will be discarded unless long-term storage arrangements are specifically made with GeoSyntec Geomechanics and Environmental Laboratory

LABORATORY TEST STANDARDS

At the request of the client, the laboratory testing program was performed utilizing the guidelines provided in the following test standards:

[X] **moisture content** - American Society for Testing and Materials (ASTM) D 2216 "*Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures*";

[ ] **moisture content** - ASTM D 4643 "*Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Method*";

[X] **particle-size analysis** - ASTM 422, "*Standard Method for Particle-Size Analysis of Soils*";

[X] **percent passing No. 200 sieve** - ASTM D 1140, "*Standard Test Method for Amount of Material in Soil Finer Than No. 200 (75 microns) sieve*";

[X] **Atterberg limits** - ASTM D 4318, "*Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*",

[X] **soil classification** - ASTM D 2487, "*Standard Test Method for Classification of Soils for Engineering Purposes*";

[ ] **soil pH** - ASTM D 4972, "*Standard Test Method for pH of Soils*";

[ ] **soil pH** - United States Environmental Protection Agency (USEPA) SW-846 Method 9045, Revision 1, 1987, Standard Test Method for Measurement of "*Soil pH*",

[ ] **specific gravity** - ASTM D 854, "*Standard Test Method for Specific Gravity of Soils*".

[ ] **carbonate content** - ASTM D 3042, "*Standard Method for Insoluble Residue in Carbonate Aggregates*";

[ ] **soundness** - ASTM C 88, *"Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate"*;

[X] **loss-on-ignition (LOI)** - ASTM D 2974, *"Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils"*,

[ ] **standard Proctor compaction** - ASTM D 698, *"Standard Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop"*,

[ ] **modified Proctor compaction** - ASTM D 1557, *"Standard Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop"*;

[ ] **maximum relative density** - ASTM D 4253, *"Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table"*;

[ ] **minimum relative density** - ASTM D 4254, *"Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density"*;

[ ] **mass per unit area** - ASTM D 3776, *"Standard Test Method for Mass Per Unit Area (weight) of Woven Fabric"*;

[ ] **thickness measurement** - ASTM D 1777, *"Standard Test Method for Measuring Thickness of Textile Materials"*;

[ ] **free swell** - United States Pharmacopeia National Formulary (USP-NF) XVII, *"Swell Index of Clay"*,

[ ] **fluid loss** - American Petroleum Institute (API)-13B, *"Section 4, Bentonite"*;

[ ] **marsh funnel** - API-13B, *"Section 4, Field Testing of Oil Mud Viscosity and Gel Strength"*;

[ ] **pinhole dispersion** - ASTM D 4647, *"Standard Test Method for Identification and Classification of Dispersive Clay Soils by the Pinhole Test"*;

[ ] **gradient ratio** - ASTM D 5101, *"Standard Test Method for Measuring the Soil-Geotextile System Clogging Potential by the Gradient Ratio"*,

[ ] **hydraulic conductivity ratio** - Draft ASTM D 35 03.91.01, *"Standard Test Method for Hydraulic Conductivity Ratio (HCR) Testing"*;

[ ] **hydraulic transmissivity** - ASTM D 4716, *"Standard Test Method for Constant Head Hydraulic Transmissivity (In-plane flow) of Geotextiles and Geotextile Related Products"*;

[ ] **one-dimensional consolidation** - ASTM D 2435, *"Standard Test Method for One-Dimensional Consolidation Properties of Soil"*;

[ ] **one-dimensional swell/collapse** - ASTM D 4546, *"Standard Test Method for One-Dimensional Swell or Settlement Potential of Cohesive Soils"*;

[ ] **unconfined compressive strength (UCS)** - ASTM D 2166, *" Standard Test Method for Unconfined Compressive Strength of Cohesive Soil"*;

[ ] **triaxial compressive strength ($\overline{\text{CU}}$)** - ASTM D 4767, *"Standard Test Method for Triaxial Compression Test on Cohesive Soils"*,

[ ] **triaxial compressive strength (UU)** - ASTM D 2850, *"Standard Test Method for Unconsolidated, Undrained Compressive Strength of Cohesive Soils in Triaxial Compression"*,

[ ] **rigid wall constant head hydraulic conductivity** - ASTM D 2434, *"Standard Test Method for Permeability of Granular Soils (Constant Head)"*;

[X] **flexible wall falling head hydraulic conductivity** - ASTM D 5084, *"Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter"*,

[ ] **flexible wall falling head hydraulic conductivity** - U S. Army Corp of Engineers: EM-1110-2-1906, *"Standard Test Method for Permeability Tests, Appendix VII"*;

[ ] **index flux of GCL** - proposed ASTM method rough draft # 1, 6/18/94, *"Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter"*;

[ ] **flexible wall falling head hydraulic conductivity** - Geosynthetic Research Institute (GRI) GCL-2, *"Standard Test Method for Permeability of Geosynthetic Clay Liners (GCLs)"*,

[ ] **permeability/compatibility** - USEPA Method 9100, SW-846, Revision 1, 1987, Standard Test Method for Measurement of *"Saturated Hydraulic Conductivity, Saturated Leachate Conductivity and Intrinsic Permeability"*;

[ ] **capillary-moisture** - ASTM D 2325, *"Standard Test Method for Capillary-Moisture Relationships for Coarse- and Medium-Textured Soils by Porous-Plate Apparatus"*;

[ ] **capillary-moisture** - ASTM D 3152, *"Standard Test Method for Capillary-Moisture Relationships for Fine-Textured Soils by Pressure-Membrane Apparatus"* and

[ ] **paint filter liquids** - USEPA Method 9095, SW-846, Revision 1, 1987, *"Paint Filter Liquids Test"*.

APPLICATION OF TEST RESULTS

The reported test results apply to the field materials inasmuch as the samples sent to the laboratory for testing are representative of these materials. This report applies only to the materials tested and does not necessarily indicate the quality or condition of apparently identical or similar materials. The testing was performed in accordance with the general engineering standards and conditions reported. The test results are related to the testing conditions used during the testing program. As a mutual protection to the client, the public, and GeoSyntec, this report is submitted and accepted for the exclusive use of the client and upon the condition that this report is not used, in whole or in part, in any advertising, promotional or publicity matter without prior written authorization from GeoSyntec.

APPENDIX C

SELECTED REFERENCES

United States Environmental Protection Agency

Center for Environmental Research Information Cincinnati OH 45268

Risk Reduction Engineering Laboratory Cincinnati OH 45268

Technology Transfer

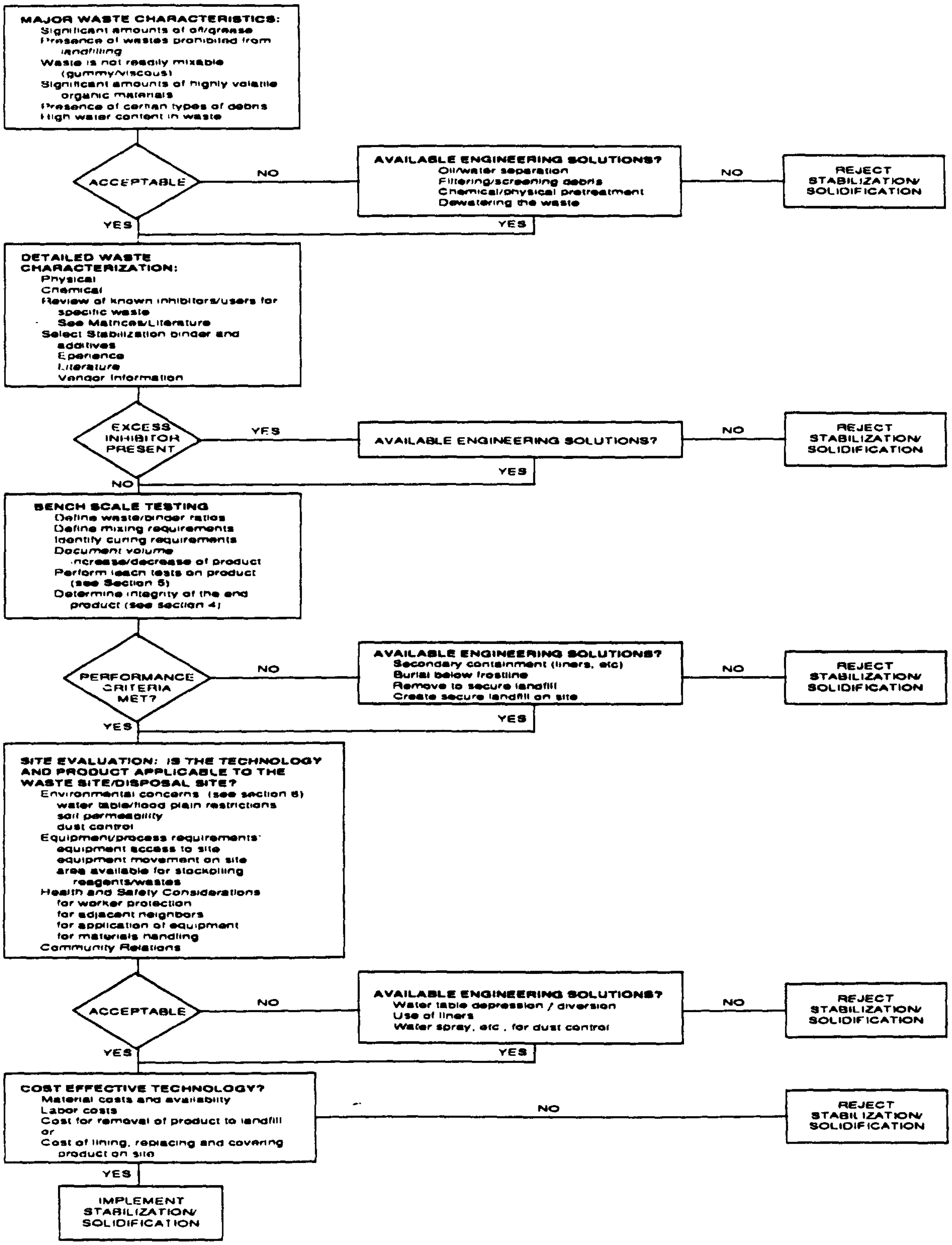
EPA/625/6-89/022

EPA

Stabilization/ Solidification of CERCLA and RCRA Wastes

Physical Tests, Chemical Testing Procedures, Technology Screening, and Field Activities

Figure 6-1. Technology screening flowchart for stabilization/solidification.



APPENDIX D

INDEPENDENT PROFESSIONAL OPINION BY KIBER ENVIRONMENTAL SERVICES, INC.

TECHNICAL MEMORANDUM
BAILEY LANDFILL SUPERFUND SITE
NORTH DIKE AREA

1.0 INTRODUCTION

1.1 TERMS OF REFERENCE

Kiber Environmental Services, Inc. (Kiber) was contracted by GeoSyntec Consultants (GeoSyntec) to provide an independent professional opinion regarding the feasibility of stabilization/solidification treatment for the North Dike Area at the Bailey Superfund Site. The scope of services was authorized by Mr. Neil Davies of GeoSyntec during a meeting at Kiber's offices on 25 September 1995. All data and information referenced herein was provided to Kiber by GeoSyntec, unless otherwise noted.

1.2 SCOPE OF WORK

Supplemental site investigations were performed by GeoSyntec Consultants during August, 1995. Kiber understands that the objective of these investigations was to provide additional information regarding the material properties and characteristics within the North Dike Area. The following information was provided to Kiber:

- Appendix A: Supplemental Site Investigation, summary of test pit logs;
- Appendix B: Laboratory Test Results, loss on ignition;
- Waste characterization results (Table 2, and Figures 2 through 10);
- Photographs taken during excavation of supplemental test pits; and
- Video documentation of the test pit excavations.

Copies of Appendix A, Appendix B and the waste characterization results are presented as attachments.

Kiber was requested by GeoSyntec to develop a technical opinion regarding the feasibility of stabilization treatment for the North Dike Area based on Kiber's review of the above-referenced information. Note that Kiber was only provided with raw data pertaining to site investigations performed by GeoSyntec. In certain discussions, Kiber has also referenced previous information gathered by Kiber at the Bailey Site.

1.3 PREVIOUS EVALUATIONS

Kiber feels that initial feasibility evaluations performed for the site lacked sufficient detail to adequately assess the feasibility of stabilization treatment and containment. Later information developed for the Site, including 1) additional stabilization evaluations and waste/soil interface investigations performed by Harding-Lawson Associates, 2) pilot-scale and full-scale treatment performed in the East Dike Area, and 3) contractor treatability studies performed on the North Marsh materials, provided pertinent information regarding the feasibility of stabilization treatment for the Bailey Site. However, none of these studies or projects provide detailed information relative to the physical characteristics of the materials contained within the North Dike Area. Harding-Lawson Associates (HLA) performed an elaborate testing program to define the waste/soil interface, and to determine a more accurate volume estimate for stabilization treatment. However, the boring and trenching logs obtained by HLA do not include adequate material descriptions of the North Dike Area.

It is Kiber's opinion that previous information generated for the Bailey Site, prior to the test pits excavated by GeoSyntec, does not adequately characterize the North Dike Area materials. The previous information cannot be extrapolated to evaluate the feasibility of stabilization for the North Dike Area. Specifically:

1. The original North Dike Area investigations performed by HLA were insufficient to adequately assess stabilization treatment in that 1) trenching was only performed along the edge of the dike in order to define the waste/soil interface, and 2) soil borings were performed along the center of the dike even though it was believed that a significant amount of municipal debris was present within the North Dike Area.

2. No attempt was made to define the amount of tar-like material. A significant quantity of tar is present in the Pit B area and the North Marsh. Detailed information pertaining to the extent of tar within the North Dike Area is deficient. HLA's descriptions indicate that the North Dike Area materials are composed

primarily of 1) black and cindery waste, 2) industrial and municipal waste, 3) black rubbery waste, and 4) black oily or tar-like waste.

3. Discussions with representatives of HLA indicated that the North Dike Area contains a significant amount of wood, metal and glass debris; and oversized debris including appliances, car bodies, wood, tree roots, and so forth. There appears to be no detailed documentation or delineation as to the extent of this debris.

4. Limited treatability testing using boring trimmings was performed on the North Dike Area waste materials that may not adequately represent the majority of the materials within the North Dike Area.

In May 1995, Kiber was contracted by the Bailey Site Settlors Committee to develop an independent evaluation of stabilization treatment for the North Dike Area based on 1) cursory review of existing data available prior to the test pits excavated by GeoSyntec, 2) Kiber's previous experience at the Bailey Site during the pilot demonstration performed in October 1994, and 3) a visit to the Bailey Site by Kiber's technical personnel on 6 June 1995. Kiber references this previous work throughout this technical memorandum.

To summarize, the evaluations performed by Kiber for the BSSC concluded that the materials within the North Dike Area were not readily amenable to stabilization treatment. However, selective stabilization followed by containment was identified as a potential remedy for selected locations within the North Dike Area.

2.0 REVIEW OF TEST PIT DATA

The data generated by GeoSyntec provides pertinent information regarding the implementation and potential effectiveness of stabilization treatment for the North Dike Area. Review of the supplemental test pit data indicates that the primary waste material within the North Dike Area may be significantly different than originally documented. Kiber believes that the supplemental test pit excavations represent the material contained within the North Dike Area. In comparison to the HLA investigations, the test pit evaluations performed by GeoSyntec were excavated approximately along the center of the North Dike Area. Kiber believes that the supplemental investigations accurately represent the North Dike Area materials.

Review of the supplemental data shows that the total waste composition of the North Dike Area materials consists of approximately 39% rubber/soil waste, 26% municipal solid waste with soil, 12% silty/clayey soil, 10% glass, 8% tar and 5% other debris. The other debris consists of oversized stones, metal and wood blended with soil. GeoSyntec referred to the rubber fragments as rubber crumb. The rubber crumb generally exhibited high elasticity, and varied from tough fairly stiff rubber, to a semi-elastic material that was very tarry and sticky. The material exhibited total organic contents, as obtained through loss on ignition evaluations, ranging from 4 to 51%. A large percentage of oily tar (approximately 8%) was also observed.

Treatment of the elastic rubber and tar material will result in operational difficulties during full-scale treatment. The material was described by GeoSyntec as having a caramel consistency. Based on Kiber's experience with similar tar materials at the Bailey Site, it is clear that these tarry materials will be difficult to excavate, handle and stabilize using conventional construction equipment. The previously selected stabilization technique for the Bailey Site includes *in situ* auger stabilization. A recent full-scale demonstration at the McColl Superfund Site located in California showed that full-scale productivity may be negatively impacted by the presence of tar-like materials. Kiber's experience at the McColl Site indicates that the presence of tar-like materials will often result in clogging of the reagent injection ports; thereby, reducing productivity. Excessive clogging of the injection ports may result in inadequate stabilization.

Previous discussions by Kiber with HLA representatives indicated that the majority of the North Dike Area consists of metal and glass fragments resulting from municipal waste disposal. Due to the municipal nature of the North Dike Area, HLA indicated that there are areas containing large oversized debris such as car bodies, appliances, boards, trees, cement blocks and so forth. Review of the GeoSyntec information shows that the North Dike Area materials contain a significantly greater percentage of municipal waste than originally believed. The test pit excavations uncovered glass bottles, oversized wood debris, metal pipes, sheet metal fragments (>2 ft^2), concrete rubble, large tree roots, 55-gallon drums and even a hot water heater.

The presence of the oversized debris seriously limits the ability of *in situ* stabilization to effectively treat the materials. Kiber's experience indicates that *in situ* treatment may be appropriate up to a maximum particle diameter of three inches. In order to effectively use *in situ* stabilization treatment for the North Dike Area, all oversized debris would need to be removed prior to remediation. The metal, wood, tree and pipe fragments will inhibit *in situ* auger operations.

Ex situ treatment is inappropriate for the majority of the North Dike Area materials due to the extensive material processing required prior to actual stabilization. Kiber typically recommends that *ex situ* treatment be performed using maximum particles sizes in the range of 3/8 inch to 1/2 inch. Therefore, extensive material processing would be required for implementation of the full-scale treatment. Material handling requirements would involve excavation, transport, temporary storage, pre-screening for bulk particle size removal (i.e., concrete rubble, appliances, metal pipes and so forth), and crushing. GeoSyntec indicated that handpicking and screening of the waste materials was difficult at best.

Based on Kiber's previous work in the East Dike Area pilot demonstration, treatability testing of the North Marsh wastes, and review of the GeoSyntec data, *in situ* stabilization of the Pit B waste materials is inappropriate, and *ex situ* treatment difficult. However, Kiber believes that selective treatment of these materials, although difficult, may be required since these materials pose the greatest environmental impact, threat for mobility, and geotechnical instabilities.

3.0 CONCLUSIONS

In summary, Kiber feels that the original feasibility study lacked the detail and focus required to adequately assess the feasibility of stabilization and containment once identified as the preferred remedy. The supplemental site investigation performed by GeoSyntec clearly shows that the materials present in the North Dike Area are not amenable to effective stabilization treatment using either *in situ* or *ex situ* processes. *In situ* and *ex situ* stabilization treatment cannot be practically implemented given the large quantity of oversized wood, glass, metal fragments and rubber/tar. However, selective stabilization treatment is recommended for portions of the Pit B area.